NURTURE VERSUS NATURE: A THEORETICAL LINK BETWEEN BREASTFEEDING AND CRIMINAL PARTICIPATION

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Abstract- This research investigates the link between breastfeeding rates in the 1960s and the crime rates observed during the 1980s. A theoretical framework is adopted in which the family nurturing decision categorized through breastfeeding increases the maternal bond. This decision, in turn, increases the stigma-costs associated with criminal behavior, decreasing the possibility of such behavior. In this context, breastfeeding usage affects the crime rate by reducing the number of individuals with low costs and high potential for engaging in criminal activity. With data on breastfeeding use from the Centers for Disease Control Family Growth Survey, this research estimates the relationship between the crime rate in the 1980s and breastfeeding use in the 1960s. This research extends the existing literature that focus on abortion, contraceptive use, obesity and attractiveness, by investigating the effect of the maternal bond on potential criminal participation. Results provide evidence that breastfeeding does have an inverse relationship significant only with violent behavior.
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Key Words- crime rate, breastfeeding, poverty, economic choice, maternal bond

Motivation

The economic modeling of crime begins with the works of Becker, Stigler and Ehrlich [1-3]. Becker attempts to find the optimal level of public and private policies to decrease the crime rate [1]. While he examines the social value of a crime, Stigler investigates various ways to decrease or limit the supply of criminals [2]. Additionally, he examines the best policies to deter criminals from committing various offenses. He conjectures that laws designed to prevent crimes are highly influenced by public policy and that public opinion are not adequate for the prevention of crime.

Ehrlich tries to explain the crime level by measuring the value of the time allocated between illegitimate activities versus legitimate activities [3]. 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 expected punishment and the cost of deterring crime compared with alternative methods of combating crime and investigates how increasing the cost certain factors such as law enforcement can deter an individual from participation in illegal activity. It is argued that there are strong peer-effects that contribute to an individual being a participant or a catalyst in criminal activity [4]. Some of the deterrents that influence negative social interaction according to this research are: strong parents, formal schooling, and information that counters peer influences. Our research adopts a theoretical framework in which

the family nurturing decision to breastfeed conditions the number of children who may later join a criminal cohort by increasing the stigma cost associated with that behavior through a maternal bond. The central aim of this research is to examine whether states who have higher family nurturing rates, categorized through breastfeeding, have lower levels of criminal participation. Most recently criminal research has focused on the social, behavioral and/or environmental factors in which juvenile delinquents are conditioned. The findings of Donohue and Levitt suggest the causal effect of abortion on crime [5-7]. Donohue and Levitt explained the decrease in the crime rates observed in the 90's to the number of abortions after Roe v. Wade 1973 [5-7]. It was also suggested that a significant relationship between contraceptive technology use during the 1970s and crime rates observed during the 1990s [8]. This line of research raises the importance of family timing on the likelihood of children's future participation in criminal activities. Unwanted children are likely to receive smaller human capital investments by their parents and are more likely to get into trouble when they get older [9, 10]. These finding are supported by the research who find that children of an unwanted or unplanned pregnancy had significantly higher delinquency rates when they were ages 11 to 17 [11]. They find a correlation between unwanted pregnancy and general delinquency, status offenses, drug offenses, and serious offenses [11].

It was revealed that being very attractive reduces a young adult's (ages 18-26) propensity for criminal activity

and being unattractive increases it for a number of crimes, ranging from burglary to selling drugs [12]. Other research considers the extent to which individual crime hazards increase with four measures of clinical obesity [13]. In his article, a Cox proportional hazard parameter estimates suggest that reductions in the incidence of obesity will improve public health and public safety by reducing crime [13]. Similar research provides evidence of how skin hue for blacks can lead to longer sentencing and higher probability of participation in criminal activity [14]. To this end, much of the research considered has involved social outcomes and criminal involvement due to various exogenous factors such as skin hue, obesity, attractiveness and the consideration of family planning.

Previous research discussed, focuses on the cost and rewards of participating in both legitimate and illegitimate labor market opportunities. An individual will choose the market that has the greatest reward/income potential given the cost associated with that activity. With income returns equaling each others in these markets, choice of labor market opportunity depends heavily on the cost associated with behavior that deters children from participating in criminal activity. In the family network, a cost that is important is the stigma-cost associated with children behavior. One of the ways to increase this stigma-cost is through the maternal relationship. Not only having the baby at the correct time is important to this maternal relationship, but also what level nurturing takes place after the baby is born. One of the ways to measure this nurturing is through the act of breastfeeding[15]. The positive outcomes of breastfeeding on children's health has been well documented in many medical journals[16]. Further research has found a statistically significant link between human adult intelligence and breastfeeding[17]. Most recently, it was identified that there is a relationship between breastfeeding and social upward mobility[18]. All of these factors discussed are linked to higher returns in the labor market versus the illegitimate labor market. Our research suggests the bond between mother and child increases the stigma cost associated with the child participating in criminal behavior as well. One of the significant ways to measure this outcome is through the decision to breastfeed.

Theory - Decision to Participate in Criminal Activity
Why might "unwanted" or less nurtured 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, then relative to children nurtured categorized by the decision to breastfeed, these children have lower costs of engaging in criminal activity[19, 20]. For example, the absence of a nuclear and extended family networks at the time of birth and a low maternal bond could result in low stocks of human and social capital. Human and social capital is important for success later in life. Therefore, less nurtured children face unfavorable schooling/labor market opportunities that reduce the opportunity cost of crime.

This 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:

$$w_0 = \mu_0 + \varepsilon_0 \quad \& \quad w_1 = \mu_1 + \varepsilon_1 \qquad (1)$$

In equation (1) μ_0 and μ_1 are interpreted as one's mean earnings in a particular activity. Consider ε_0 and ε_1 as the mean value of an individual's skills in a particular profession with $\varepsilon_0 \sim N(0, \sigma_0^2)$ and $\varepsilon_1 \sim N(0, \sigma_1^2)$.[1] 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.

$$I = \ln(w_1 /(w_0 + C)) \approx (\mu_1 - \mu_0 - \pi) + (\varepsilon_1 - \varepsilon_0) \quad (2)$$

Equation (2) accounts for time by the term $\pi = C/w_0$. [20] 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 level of nurturing, nuclear and/or extended family network, the community resources, or national policy that is present. This network and/or nurturing decisions then serves to condition behavior, creates a system of rewards/punishments, and provides a source of social capital that expands the set of legitimate opportunities for a child. The decision to breastfeed allows for an increased maternal bond between mother and child increasing the cost and limiting criminal behavior.

This nurturing decision can also increase the costs associated with illegal activities by imposing upon a child higher moral costs. Similar to the costs associated with the "shaming" to members of one's family network. This stigma-cost associated with a family's nurturing decision is increased when resources, such as maturity, time, income, etc., are available. Breastfeeding increases the

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[1] 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)

cost associated by increasing the maternal bond present with the child and mother. Arguably, this would impact crime through the increased stigma-cost associated with the presence of a more nurturing family network.

If we assume that stigma-costs are higher when a decision to nurture is available, then a child who is breastfed would have a higher stigma-cost associated with participating in criminal activity. Conversely, a child born and not breastfed may not have the maternal bond necessary in place, thereby creating a lower stigma-cost associated with participating in criminal activity.

Building on equation (2), the correlation between illegal and legal earning can be defined as follows:

$$\rho = \frac{\sigma_{01}}{\sigma_0 \sigma_1}, \text{ where } \sigma_{01} \text{ is the cov } (\sigma_0, \sigma_1) \quad (3)$$

Implementing this model requires knowledge about ρ, however we do not need to know ε_0 and ε_1.[20] It follows that an individual will participate in criminal activity when the index function, I > 0 or:

$$(\mu_1 - \mu_0 - \pi) + (\varepsilon_1 - \varepsilon_0) > 0 \quad (4)$$

The terms in the first parentheses suggest that the difference between the mean earnings of illegal activity (μ_1) minus the mean earnings from legal activity (μ_0) 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.

It follows from equation (4) that the probability of choosing an individual at random who will participate in illegal activities instead of legal activities can be derived.

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

$$P = \Pr[v > (\mu_0 - \mu_1 + \pi)] = \Pr\left[\frac{v}{\sigma_v} > \frac{(\mu_0 - \mu_1 + \pi)}{\sigma_v}\right]$$

$$= 1 - \Phi\left(\frac{(\mu_0 - \mu_1 + \pi)}{\sigma_v}\right) = 1 - \Phi(z) \quad (5)$$

Where $z = \left(\frac{(\mu_0 - \mu_1 + \pi)}{\sigma_v}\right)$.

In equation (5) Φ is equal to the standard normal distribution [20]. 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 nurturing decision is present. This suggests that the probability of an individual participating in a criminal activity would be lower when children are breastfed.

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 breastfeeding as a variable that empowers individuals to better influence the environment (i.e. maternal bond) around which children are reared. The theory of optimal breastfeeding use and the adoption of criminal activity suggest empirically that the crime rate will be a function of breastfeeding usage sufficiently lagged to account for the timing of the entry of a birth cohort into the criminal cohort.

Data and Methodology

Data on individual breastfeeding usage are taken from the National Survey of Family Growth (NSFG).[2] The NSFG, sponsored by the Center for Disease Control (CDC), covers cycles for the years 1973 -1995. This data provides an opportunity to verify if variation in the usage of breastfeeding by individuals in the 1960s across states had an effect on crime rates in the 1980s. Due to the limitation of the survey, these years were selected due to convenience. The NSFG conducts the national samples of women ages 15-44, interviewed in person in their households.

To further the examination of breastfeeding rates, this research examines the growth of feeding practices over time as expressed in figure 1. [See Figure 1]

Figure 1 was gathered from the "Mothers Survey, Ross Products Division of Abbott" who examines breastfeeding rates across the United States. Breastfeeding rates for Total Population, Non-Women Infant and Children (WIC) and WIC and for in hospital patients, suggest an increasing trend from the 1970 to 2008. The rates shown in Figure 2 provide even more evidence of the amount of breastfeeding practices that last at least 6 months. While the trends are similar to the in hospital breastfeeding rates, they are much lower. [See Figure 2]

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2 The data was 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. The state effects after 1976 could not be observed.

The previous figures (1 and 2) provide a picture of the utilization rates that will be constructed to examine the effects that breastfeeding has on criminal participation.

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 2008 for every state in the US. 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, unemployment rate, and the per capita state personal income will be gathered from the Census Bureau United States Statistical Abstract.

This research will estimate the parameters of an econometric model of crime rates where the characteristics of the family nurturing decision condition behavior for juveniles' participation in criminal activity. This study will determine whether the amount of nurturing as measured through breastfeeding leads to a reduction of property and violent crime rates. Due to the nature of this panel data set, the preferred estimation technique will include a fixed effect regression method.

To understand the affect that each family's nurturing decision characteristic has on criminal activity, this research proposes the construction of a Utilization Rate. This Utilization Rate will allow us to construct a variable that allows us to show variance in proportion over time. As stated below, the Utilization Rate measures the amount of use divided by the total amount.

$$Utilization\ Rate_i = \frac{Total\ number\ in\ population\ with\ Characteristics}{Total\ number\ of\ population} \quad (6)$$

where i represents breastfeeding practices

Equation (6) is the Utilization Rate calculated from a sample of the National Family Growth Survey. This proposal estimates the function as

$$(Crime_{st}) = \beta_1(Utiliztion_{s,t-17}) + \beta_i X_{st} + \gamma_s + \lambda_t + \varepsilon_{st}$$
$$for\ i = (2, \cdots, n) \quad (7)$$

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. The variable denoted as "X", is a vector that includes the number of prisons and police per capita, the unemployment rate, per capita income, the poverty rate, presence of concealed handgun laws, and per capital beer consumption. These variables are the same ones supported by prior research [5-7]. All of these variables as denoted in "X" have been accepted by literature as contributing factors to the crime rates.

Results
Table 1 reports the Mean, Standard Deviation, Minimum and Maximum for the sample of relevant variables. For the 50 states and Washington, DC in the sample, the following variables were constructed: the number of violent crimes per 100,000 (VIOLENT), the number of property crimes per 100,000 (PROPERTY), the rate of unemployment per population (UNEMPLOY), the percentage of people below the poverty line per state (POVERTY), a binary variable indicating whether or not the state has the presence of a concealed gun law (GUNLAW), the per capita income (INCOME), the amount of beer consumption per population (BEER), the number of police per capita (POLICE) lagged one year, the number of prisons per capita (PRISON) lagged one year, and the breastfeeding rate per state (BREASTFEED) lagged 15 years[3] [See Table 1].

Table 1 report that the average rate of breastfeeding practiced during the 1965 thru 1973 was about 25%. This is closely related to the percentage reported previously of 23% breastfeeding rate. Table 1 also reveals the unemployment rate and the poverty rate during the 1980 – 1988 of 7% and 14 % respectively.

Because the use of breastfeeding does not immediately affect the crime rate, the Utilization Rate is gathered from an earlier period than the crime rate. In this research, a 15 year difference is selected between the decision to breastfeed and the crime rate. For clarification, if a person was breastfed in 1965, its effect on crime will not be apparent until 15 years later in 1980.

A specification of the process generating crime is as follow:

$$\ln(Crime_{st}) = \beta_1 \ln(Contraceptive_{st}) + \beta_i \ln X_s + \gamma_s + \lambda_t + \varepsilon_{st}$$
$$for\ i = (2, \cdots, n) \quad (8)$$

where "s" indexes the 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 double log model, a semi-log model will be used to examine the effect of a utilization rate on the decreasing crime rate:

Given the possibility of unobserved heterogeneity, which introduces a bias in the OLS parameter estimates, Table 2 shows the Fixed Effects parameter estimates respectively for equations (8) in the constructed double log estimation and also in a Semi Log Fixed effect model [See Table 2].

Table 2 reveals the (Breast Feeding Rate) is significant for violent crime for the double-log estimation. It also shows significant results for (Per Capita Income), (Unemployment) and (Constant). The variable of consideration, breastfeeding is not significant for any other estimation model but it does have the appropriate sign for all model specifications. Due to the nature of the variable in the semi-log method, many of the variables are not significant. For violent crime, only Per Capita Income is significant. Property crime reveals significant results for (Unemployment) and (# of police per capita)

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[3] The following States contain missing data with regards to breastfeeding: Alaska, Delaware, Hawaii, Idaho, Maine, Nevada, New Hampshire, New Mexico, North Dakota, South Dakota, Rhode Island, Utah, Vermont and Wyoming.

for the double log model of estimation. The Semi-log model reveals significant values for (# of police per capita), (per capita income), (# of prison per capita) and (Constant). Once again, the (Breast feeding Rate) is not significant but does have the expected sign.

Conclusion

While much of the economic literature has focused on deterrents to criminal behavior, recent literature increases the awareness of the effect of abortion, attractiveness, skin hue, and obesity on criminal activity. This research continues the line of thinking by increasing the effects of nurturing, categorized through breastfeeding, in decreasing criminal participation. Although much of the results were not significant, it does provide evidence that further research is necessary to fully understand the effects of breastfeeding and criminal participation. It is considered through this research that more emphasis on breastfeeding data is necessary to fully address this relationship. However, policy makers now find strength in arguing laws that govern more time for mothers and children to bond in the form of various programs such as the La Leche League International, a program for breastfeeding mothers and consultants. Such program for high school students who just recently had a child could be effective when offering a time for mother and child to bond. By allowing individuals time and education that increases maternal bonding, has a high probability of lowering long run social cost associated with criminal processing and incarceration.

References

[1] Becker Gary (1968) *The Journal of Political Economy* 76 (2), 169-217.

[2] Stigler George (1970) *The Journal of Political Economy* 78 (3), 526-536

[3] Ehrlich Isaac (1973) *The Journal of Political Economy* 81 (3), 521-565.

[4] Glaeser Edward L., Bruce Sacerdote, and Jose A. Scheinkman (1996) *The Quarterly Journal of Economics*, 111 (2), 507-548.

[5] Donohue John J. and Levitt Steven D. (2001) *Quarterly Journal of Economics* 116 (2), 379-420.

[6] Donohue John J. and Levitt Steven D. (1999) *Stanford Public Law and Legal Theory Working Paper Series, (1).*

[7] Donohue John and Steven Levitt. (2004) *Journal of Human Resources.* 39 (1), 29-49.

[8] Hill Nicholas (2007) *Is it Really Safe Sex. Annual American Economic Association Conference.*

[9] Lott John R. and John Whitley (2007) *Economic Inquiry*, 45,(2), 304–324.

[10] Bouza Anthony V. (1990) *The Police Mystique. New York, NY: Plenum Press.*

[11] Hay Carter and Michelle M. Evans(2006) *Journal of Research in Crime and Delinquency* 43 (1), 36-66.

[12] Naci Mocan and Erdal Tekin (2006) Ugly Criminals, *NBER Working Papers*, 1201.

[13] Price Gregory N. (2009) *Economics Letters*, 103 (3), 49-152.

[14] Kwabena Gyimah-Bremponga and Gregory N. Price (2006) *American Economic Review*, 96 (2), 246-250

[15] Cubbin Catherine, Kristen Marchi, Thomas Bell, Helen Marshall, Curt Miller and Paula Braveman, (2008) *Maternal & Child Health Journal*, 12 (1), 61-74

[16] Cattaneo Adriano (2008) *Journal of Pediatrics & Child Health*, 44 (1)

[17] Mortensen, Erik Lykke, Kim Fleischer Michaelsen, Stephanie A. Sanders, June Machover Reinisch, (2002) *JAMA.* 287, 2365-2371

[18] Martin Richard M., Sarah H Goodall, David Gunnell, and George Davey Smith (2007) *Archives of Disease in Childhood,* 92, 317-321

[19] Roy A. D. (1951) *Oxford Economic Papers,* 3 (2), 135-146

[20] Borjas George J. (1987) *American Economic Review*, 77 (4), 531-553.

Table 1- Sample Mean, Standard Deviation, Minimum and Maximum

| Variable	Obs	Mean	Std. Dev.	Min	Max
Violent Crime per 100,000	459	468.3895	301.1294	47	2274.8
Property Crime per 100,000	459	4632.13	1237.196	2053.4	8402.8
Breastfeeding Rate	315	0.2409474	0.2209076	0	1
Unemployment Rate	459	0.0731709	0.0238503	0.02508	0.18033
Poverty Rate	459	14.00349	4.389471	3.7	27.2
Welfare Generosity	204	7957.814	2789.91	2255.676	15435.65
Gun Law	459	0.1721133	0.3778908	0	1
Beer Consumption per capita	255	23.9698	4.219479	12.8	39.3
Per capita Income	459	19775.85	3325.604	13336.33	31426.29
# of Prison Per capita	459	1.65218	0.9838605	0.20827	8.813186
# of police per capita	459	2.578389	0.7710808	1.703077	7.387689
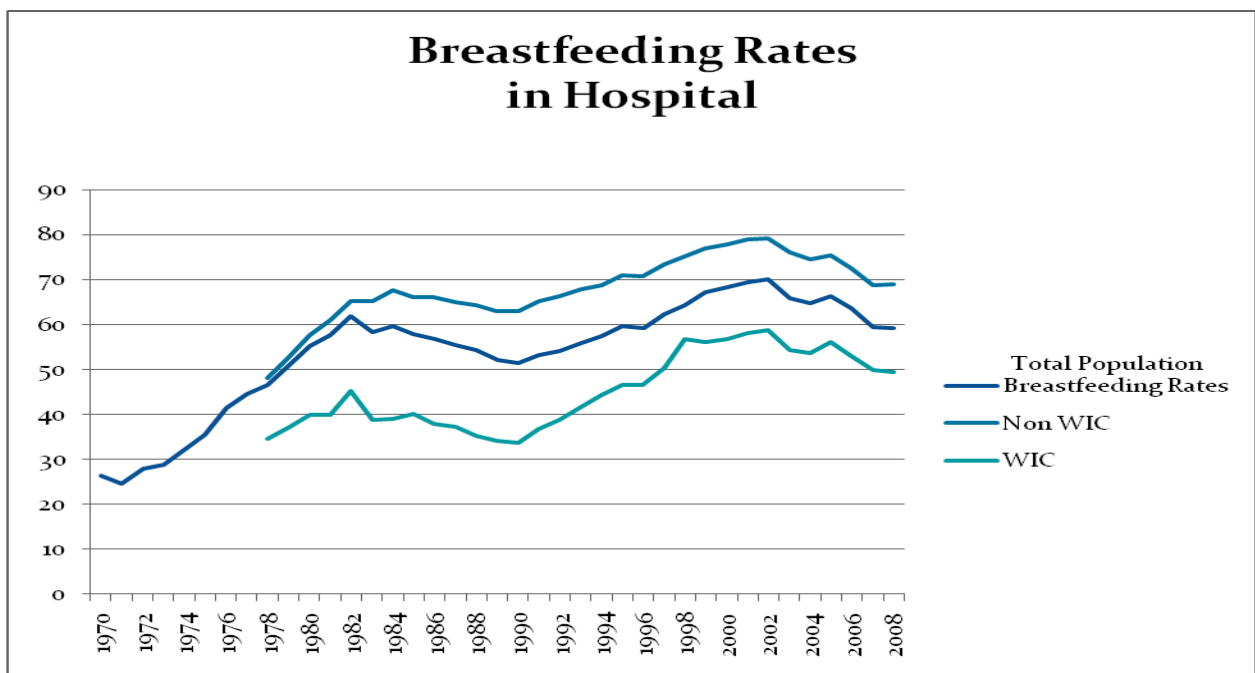
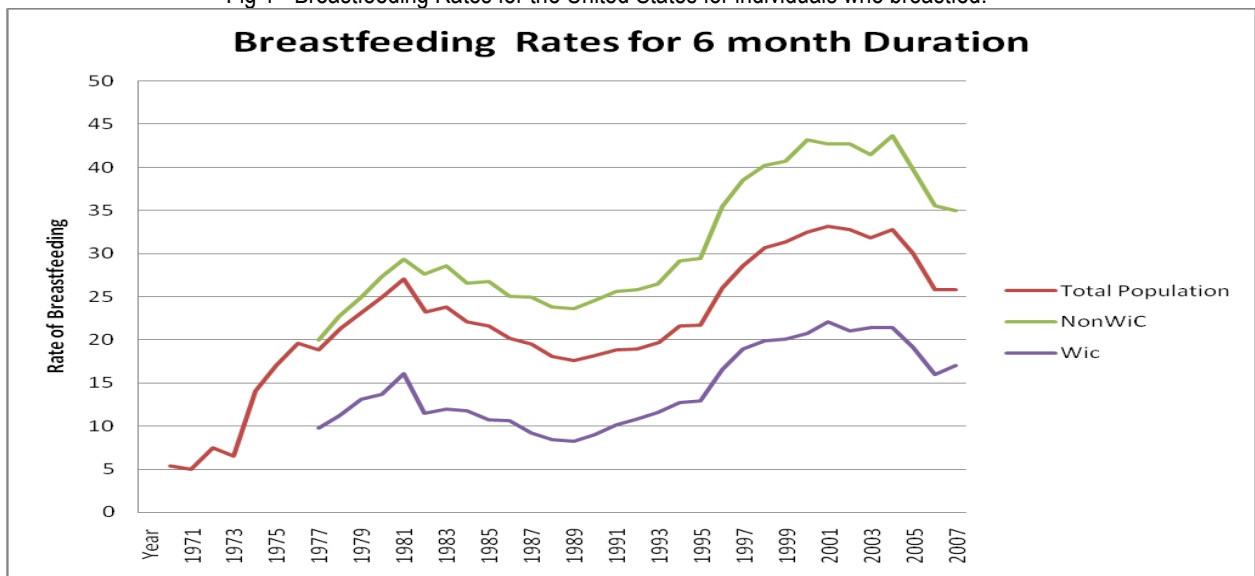Fig 1 - Breastfeeding Rates for the United States for individuals who breastfed.

Fig 2: Breastfeeding Rates for the United States for individuals who breastfed for at least 6 month.

Table 2: Fixed Effect Regression Model for Violent and Property Crime

	Double Log		Semi Log	
	ln (Violent)	**ln (Property)**	**ln (Violent)**	**ln (Property)**
Breastfeeding Rate	-0.0297829[b] (.015)	-0.0103485 (.008)	-0.020912 (.052)	-0.0005305 (.026)
Unemployment Rate	0.1031372[c] (.079)	0.0580957[a] (.043)	0.8447071 (1.19)	0.9171714 (.610)
Poverty Rate	-0.0115259 (.076)	-0.0122567 (.041)	0.0029839 (.006)	-0.0006422 (.002)
Welfare Generosity	-0.2237715 (.116)	-0.1901358 (.063)	-0.00000844 (.000)	-0.0000127 (.000)
Gun Law	-0.0068601 (.048)	0.039648 (.026)	-0.0208488 (.058)	0.0388396 (.030)
Beer Consumption per capita	0.2123922 (.410)	-0.1317153 (.221)	0.0168573 (.016)	0.002902 (.008)
Per capita Income	0.9906272[b] (.444)	0.7888127 (.241)	0.0000356[b] (.000)	0.0000207[a] (.000)
# of Prison Per capita	0.1779149 (.112)	-0.0952007 (.061)	0.0285615 (.036)	0.037372[a] (.019)
# of police per capita	0.3732153 (.335)	0.6866087[a] (.182)	0.2065695 (.130)	0.210075[a] (.065)
Constant	-7.121781[c] (4.24)	-2.326367 (2.31)	-0.2014646 (.593)	2.709139[a] (.302)
R-squared	.67	.21	.47	.27

[a]Significant at the .01 level, [b]Significant at the .05 level, [c]Significant at the .10 level, Standard errors in parentheses