Rochester Center for Economic Research

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Working Paper No. 389
August 1994

University of
Rochester

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by

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Initial Draft: July 5, 1994
August 1, 1994

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We wish to thank Marcus Berliant, Stanley Engerman, Miguel Gouveia, Bruce Hansen, Eric Hanushek and participants at the applied workshop at the University of Rochester for helpful suggestions. Responsibility for any errors and opinions rests solely with the authors.

Abstract

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The purpose of this paper is to develop a classical model of the teen fertility decision in the presence of public income transfers. In it, teen girls choose from the two options of either completing her education and then seeking work or getting married, or becoming a single parent and gaining access to AFDC, Food Stamps, Medicaid, and housing and energy assistance. Our theoretical model predicts that welfare payments will encourage such dependency, holding constant other economic opportunities, and that better economic opportunities will discourage dependency.

Empirically, we confirm the model's predictions with state level data for 1980-9. We find that real welfare benefits are strongly and robustly related to teen illegitimacy. The elasticity with respect to changes the illegitimacy rate is around +.5. Also, real wages are negatively related to teen illegitimacy. This real wage result is robust, and the elasticity with respect to the illegitimacy rate is around -.25. Finally, the declining pool of marriageable men is accompanied by rising teen illegitimacy rates. These three empirical results are consistent with the theoretical model's predictions.

Contents

1 Introduction

The assertion that economic considerations play a significant role in family formation and fertility decisions is neither new nor controversial. The observation that there is a systematic interplay between economic considerations and fertility dates at least to Malthus (1798). In his *Essay on Population* and *Summary View on Population*, he provided a series of conjectures and empirical evidence in support of the view that agricultural productivity provided an overall restraint on the positive and negative influences on birth rates. Subsequently refined and debated, the classical theory of population was summarized by Blaug(1978) as the proposition that:

> ...the production of children, [is] not as a means of spending income on "consumer goods" to acquire satisfaction, but as a method of investment in "capital goods" for the sake of a future return. (Blaug (1978), p. 78)

While this classical view has been adequate for loosely explaining population dynamics in agrarian societies, the modern economic theory of the family, due mainly to Becker (1991), views the fertility decision and the possession of children to reflect the consumption motive rather than the investment motive.[2] Undoubtedly across most of the range of the income distribution in industrialized economies, the consumption view of children is the more suitable and powerful explanation. However, for individuals in poverty, various public cash and in-kind transfers create a series of economic incentives which, as we shall develop below, make the child bearing decision equivalent to the Malthusian analysis that children are income producing assets as well as sources of consumption utility. In the modern welfare state, it is the transfer system which creates income producing opportunities rather than agricultural production.

This observation, that the U.S. welfare system may encourage fertility, especially among

[2] Another interesting example of the investment view of children is the English Poor Laws in the eighteenth and nineteenth centuries. Boyer(1990) finds that child allowances, a common form of poor relief for able bodied laborers, had a positive effect on birthrates (p. 172).

poor single women, by making children income producing assets as well as consumption goods is not novel. Becker (1991), for example, observed:

> Payments to mothers with dependent children are reduced when the earnings of parents increase, and are raised when additional children are born or when fathers do not support their children. It is a program, then, that raises the fertility of eligible women, including single women, and also encourages divorce and discourages marriage....

The growth in public transfers has been accompanied by a sizeable empirical literature in sociology and economics on the interaction between various family formation decisions and the welfare state. In general the empirical evidence that the United States' welfare system encourages illegitimacy, and in particular teen illegitimacy, is not conclusive. Furthermore, despite many empirical tests, there remains a paucity of formal models of the decisions that a recently fertile girl faces in the presence of potential sexual partners.

Our purpose here is thus to construct formally a "classical" model of the fertility decision, and then to test it empirically with U.S. data for the 1980's. We focus specifically on the effect that welfare has on teen fertility for several reasons. The first is that although few AFDC households are headed by teen girls (only 3-4%) a much larger proportion are headed by women who were teen mothers (around 40%).[3] A second point is that teen mothers tend to be less well educated and spend longer on AFDC than other participants.[4] Finally about half of unwed teen mothers become welfare recipients within two years of their first birth.[5] Overall unwed mothers appear likely to enter the AFDC program and then once they do they spend longer in the program than other women.

To summarize the results, the utility maximizing model leads us unambiguously to expect welfare payments to encourage initial dependency through illegitimacy. It also leads

[3] Government Accounting Office (1994).

[4] Women who enter the welfare system under the age of 22 at the time of their first spell spend an average total duration of 8.23 years on AFDC; women who are between 22 and 30 spend only 7.08 years and women aged 31 to 40 spend only 5.15 years Committee on Ways and Means(1992), p. 687).

[5] Government Accounting Office (1994).

us to expect that better employment and wage opportunities for young women will decrease the likelihood that they will decide to become dependent on public support through illegitimacy, and that declining marriage opportunities will increase dependency and illegitimacy pressures.

Our empirical evidence for the 1980's confirms these predictions, finding transfer elasticities with regard to teen illegitimacy rates on the order of +0.5, and wage elasticities with regard to teen illegitimacy rates on the order of -0.25.

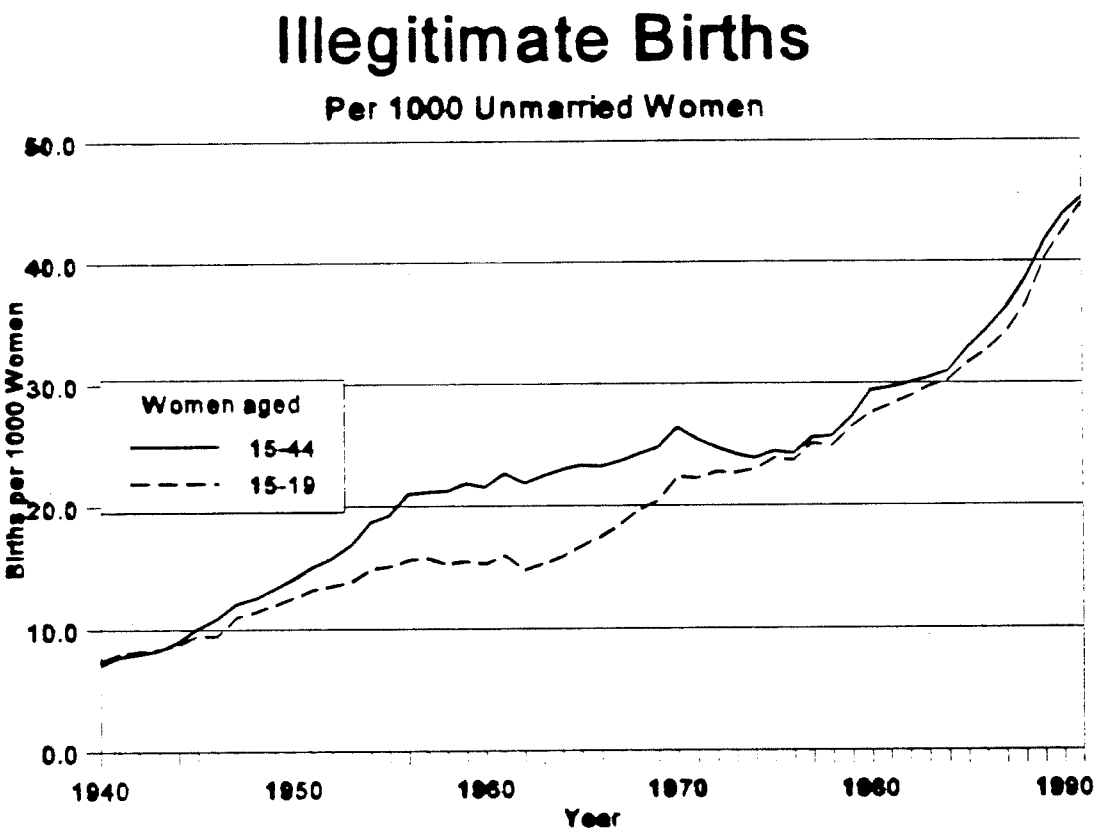
The organization of the paper is as follows. Section 2 presents a brief review of modeling considerations arising from the literature and some stylized facts. Section 3 develops and explores a formal economic model of the dependency decision. A young, fertile girl is viewed as facing the choice to 1] complete her education and seek work or get married, or 2] become dependent as a single parent through having a child, and gain access to AFDC, Food Stamps, Medicaid, and housing and energy assistance. Section 4 discusses the data collected to test the model, econometric modeling considerations, and presents and summarizes the empirical results. Section 5 concludes.

2 Some Stylized Facts and Past Empirical Work on Illegitimacy

Much of the recent concern about the effect of welfare benefits on illegitimacy has been stimulated by the large increase in births to unmarried women since the end of the Second World War. The number of illegitimate births per 1000 single women of childbearing age has nearly trebled over the past 40 years - the rate has more than trebled among teens [See Figure 1].

A common assertion is that this is due to changes in welfare benefits available to single women with children encouraging, or at least allowing, single women to bear children out of wedlock. One common objection to this conjecture is that the in real terms welfare benefits available to single mothers have not continuously grown over this period. One often cited measure of the value of welfare benefits is the combined value of AFDC and Food Stamp

Figure 1: Illegitimacy Rates: 1950-1991



payments to a family with no other income.[6] The value of this bundle grew slowly in the early sixties, and then accelerated during the late sixties and early seventies. However, since the mid 1970s in real terms benefits have generally been either flat or declining. Moffit (1992) states this stagnation makes it unlikely that changes in welfare benefits alone explain the rapid growth in illegitimacy.

However, this argument does not show that changes in benefits have played no role in the increase in illegitimacy over the past 40 years. Even if the real value of welfare benefits has not been growing continuously, it may have been growing relative to other economic opportunities available to the young woman. In *A Treatise on the Family* (1991, p.16), Becker observed:

> ...my analysis of the marriage market indicates that the incentive to remain single depends upon income while single relative to income expected if married. The real wage rate of young male high school dropouts and the lowest quartile of graduates has dropped by more than 25% over the past 15 years and these young men may have become less attractive marriage partners for other reasons as well.

It is still possible that welfare has interacted with other variables to cause the rapid growth, even if it is not the only, or even the main, contributor to the growth in recent times.

Looking at changes in illegitimacy and benefits over time provides one way of testing the relation between the two. Another way is take advantage of states, setting their own AFDC benefits levels.[7] As Murray (1993, p. 225) notes this variation appears to "...provide a natural experiment for testing the proposition that welfare is linked to family breakup."

[6] Since Food Stamps were introduced in the late 1960's this measure is usually extended prior to this by only counting AFDC benefits.

[7] This has led to benefits varying greatly between states - in 1991, the AFDC payment to a mother with one child and no other income varied between $120 per month in Mississippi and $694 per month in California. Including Food Stamps in the measure of total benefits reduces interstate differences, but differences still remain substantial.

If welfare was the primary cause for the observed increase in illegitimacy, it would seem reasonable to expect that states with higher benefit levels would also have higher illegitimacy rates, and to expect that women in those states would be more likely to give birth out of wedlock. A number of studies have exploited the differences in benefit levels to test whether welfare benefits seem to have an effect on either the probability that an unmarried women will have an out of wedlock birth using discrete choice models, or to test the aggregate relation between benefit levels and the state's illegitimacy rate.

However this past empirical work investigating the link between AFDC and illegitimacy has not been conclusive. While some studies have found a positive relation [e.g. Caudill and Mixon (1993); Ozawa (1989)], many other studies have found mixed or statistically insignificant positive results [e.g. Duncan and Hoffman (1990); Lundberg and Plotnick (1990); Acs (1993)], and others have even some found negative correlations among their results [e.g. Ellwood and Bane (1985)]. Moffit (1992) summarizes various studies written between 1982 and 1990 on the effects of welfare benefits, and concludes that there is only "mixed evidence of an effect of the welfare system on illegitimacy." Murray (1993) and Acs (1993) examined other studies, but reached the same basic conclusion.

There are several plausible reasons for the mixed empirical results. The first is that different studies use different levels of aggregation and different left hand side variables. Some studies have used panels of individual data, from surveys such as the National Longitudinal Survey of Youth (NLSY) and the Panel Study of Income Dynamics (PSID), while other studies have concentrated on aggregate data. Aggregate studies measure illegitimacy as the illegitimacy *rate* defined as the number of illegitimate births per 1000 single women or girls or as the illegitimacy *ratio* defined as the number of illegitimate births per 1000 total births.[8].

These aggregate measures have several common limitations. One issue is that changes in welfare payments affect both the number of children a single women chooses to have, and also the number of single women. These are two separate concerns, and, as shown below, it is possible that changes in welfare payments may affect each differently. The illegitimacy

[8]Recently, Murray (1993) proposed using the number of illegitimate births per 1000 women (both married and unmarried)

ratio has additional problems because variables commonly included in the illegitimacy regressions, for example per capita income and wages, may affect the fertility decisions of married women, as well as the women's choice regarding marital status. Among the aggregate studies, however, the studies that have used illegitimacy ratios have tended to find the strongest relation between welfare and illegitimacy [e.g. Caudill and Mixon (1993) and Ozawa (1989).]

Another reason for the mixed findings is that different studies use different independent variables in their regressions to control for the other options the woman has available. In panel studies of individuals this can be quite difficult, because many of the woman's other choice variables, like wages or final educational level, are highly endogenous, and for teenage girls especially - the group most often studied in panel studies of individuals - very difficult to measure since they are unobserved. When using aggregate data, measuring the woman's other options with variables such as per capita income may be misleading if the income of high school dropouts or graduates have fallen relative to average income and these groups are more likely to give birth out of wedlock.

A final problem, which was noted in a study on the effects of welfare on various family decisions by Ellwood and Bane (1985), is that a state's benefit level is not set independently of the social and political structures of that state. Many unobserved, and possibly unobservable, traits may affect both the benefit levels that each state sets and also encourage, or discourage, single motherhood. If the regression relating welfare to the woman's choice does not include these traits, the estimated coefficient on benefits will be inconsistent. This criticism applies to studies using both aggregate and individual data. However after attempting to control for these unobserved effects, Ellwood and Bane (1985, p. 199) still conclude that none of their methods "give much evidence of a serious influence of welfare on births to unmarried women." [9]

[9] Other studies have also noted this problem and have used fixed effects models to study the effects of various family decisions [e.g. Jackson and Klerman (1993)]. The basic assumption behind this approach is that if the unobserved state effects are constant over time (or across states for time effects) then including time and state dummies will remove the bias.

3 A Model of Teen Fertility

The recent theoretical literature on fertility has concentrated mainly on the interplay between child quantity and quality decision and inter-generational transfers, (e.g Becker (1991), Barro and Becker (1988), or Cigno (1986)). The number of children, as well as some measure of "quality" enter the family's utility function along with other consumption goods and this is then maximized with respect to some budget constraints. Leisure is usually not explicitly included in the utility functions. However, in the choice between work and marriage or welfare, leisure appears to play an important role. For simplicity we assume that the time cost of having a child is fixed - there is no child quantity-quality tradeoff in the model presented below. Instead, children restrict time available for leisure and so leisure acts as a brake on the number of children a woman would choose to have.

A utility maximizing woman faces a discrete choice between some combination of marriage and work on the one hand, or welfare on the other and she chooses the path that will give her the greater utility. Whichever choice she makes she maximizes her utility by choosing the appropriate amounts of the three arguments in her utility function: leisure, consumption and the number of children. For women who choose work and marriage, children are essentially a consumption good. For poor women on welfare, children are more then just a consumption good, they are also an income producing asset - they provide the mother with a monthly check.

Children are assumed to be a discrete good consuming two different sorts of parental resources:

1. *Money.* There is a financial cost, $p_b > 0$, associated with having and raising each child.

2. *Time.* In addition there is a time cost, $t_b > 0$, involved with raising each child. This cost is assumed to be fixed and should be interpreted as the minimum time investment the mother needs to bear and raise the child.[10]

[10] Results in this section are similar if the time cost of children is assumed to be an increasing, but possibly non-linear, function of the number of children. To ensure in the welfare case that the woman's budget set is

These minimum requirements are not substitutable - one cannot reduce the time commitment required to care for a child by increasing money expenditures and cannot reduce the financial cost by increasing time expenditure.

A further assumption is that the woman actually has the number of children that she wants to have; that is, there is no stochastic element to childbearing in this model. The woman's utility function is assumed to be continuous and to satisfy a nonsatiation condition. The price of consumption is normalized to one.

Table 1: Variables in the Model

Variable	Interpretation
b	Children (babies)
c	Consumption
l	Leisure
I	Partner's Income
t_b	Time cost of child
p_b	Money cost of child
w	Woman's wage
L	Woman's labor
m	Time Endowment
V(b,L)	Cost of child care given b children and L hours of labor
g_1	Basic government welfare grant (guarantee)
g_2	Additional welfare grant per child

A woman who chooses marriage and work must decide how to divide her time between the three demands of child rearing, work and leisure, and her income between child care if she works, child rearing and consumption. Since her utility function has a nonsatiation

compact it is necessary to make the additional assumption that either there is a physiological maximum on the number of children that the woman can have, that $g_2 < 0$, or that the time cost of an additional child is always greater than or equal to some δ which is strictly greater than zero. In the comparative statics section to ensure that the first order conditions characterize a maximum an additional assumption, such as a convex time cost function, would be needed.

property the inequalities in the budget constraint are replaced with equalities:

$$\begin{aligned} Max \quad U(b,c,l) \quad such\ that \quad & p_b^* b + c + V(b,L) = I + wL \\ & l + t_b^* b + L = m \end{aligned} \tag{1}$$

The first constraint is the woman's financial constraint. The financial cost of bearing and raising her children, the cost of child care and the cost of consumption is equal to the sum of, I, the woman's partner's income which is assumed not to be a function of the number of children, plus wL, the woman's labor income.

The second constraint the woman faces is a time constraint. She must choose how to appropriately divide her time between leisure, child care and labor. It is assumed that the entire child care time commitment could not be handled by the woman's partner. Biologically the only constraint is that, if the woman's partner is male, she must bear the child. However in the United States, at the present time, it is common for the mother to provide child care; in fact usually the mother is also the primary care giver. Of course this constraint would hold in the same way for a single mother not receiving welfare, although her time cost of children may be different than a married woman's time cost.

If the woman chooses welfare instead of work and marriage, it is assumed that she will not work, perhaps due to program requirements. In reality AFDC does allow a woman to work, but either due to the high child care costs or possibly due to the high marginal tax rates that women on AFDC face, most women do not work.[11] Spousal income is also restricted to be zero - women on welfare are assumed not to be able to marry. Since 1990, all states operating AFDC programs have been required to also operate an AFDC-UP program (Committee on Ways and Means (1992), p. 609).[12] However because the primary breadwinner must be unemployed to receive AFDC-UP payments, effective spousal income would be zero in this case also.

[11] Committee on Ways and Means (1992,p. 680) reports that in 1990 nationally only 8.2% of recipients have any earned income at all.

[12] AFDC-UP provides aid to needy children in families where the primary breadwinner is unemployed.

Her maximization problem if she choose welfare is therefore:

$$Max \quad U(b, c, l) \quad such\ that \qquad \begin{aligned} l + t_b b &= m \\ p_b b + c &= g(b) \end{aligned} \tag{2}$$

where g(b) is the welfare payment function, the money a woman receives from the state to support b children. The variables t_b and p_b are the time and money costs of having a child (these are not necessarily the same as t_b^* and p_b^*, the time and money costs faced by a married woman).

For simplicity g(b) is assumed to take the following form

$$\begin{aligned} g(b) &= g_1 + g_2^* b \quad for\ b > 0 \\ &= 0 \qquad\quad for\ b = 0 \end{aligned} \tag{3}$$

Given that g(b) is a linear function of children, the time constraint can be rewritten as:

$$c = g_1 + g_2 b \tag{4}$$

where

$$g_2 = g_2^* - p_b^* \tag{5}$$

Throughout the following discussion g_1 is referred to as "the base welfare grant" - the money all women on welfare receive, whereas g_2 is referred to as "the additional grant" for additional children. It is assumed that no consumption is extremely unattractive and that for some b*, m - t_bb* > 0 and $g_1 + g_2$b* > 0. That is, if a woman "chooses welfare", she will not choose to have no babies and therefore receive no welfare payment.[13] Note that g_2 may be either less than or greater than zero depending upon whether the additional welfare transfer per child (g_2^*) is more than or less than p_b^*, the minimum financial cost of having a child. These two maximization problems (1) and (2) can be solved to find indirect utility functions

V_m (p_b^*, t_b^*, I , w) [utility from marriage given p_b^*, t_b^*, I ,w] and

V_w (t_b , g_1 , g_2) [utility from welfare given t_b , g_1 , g_2]

The following observations follow from the simple model

[13]For example assuming that u(b,0,l) < u(b',c',l') where b, l, b', l' ≥ 0 and c' > 0 will ensure this.

Proposition 1 *An increase in I will increase V_m and an increase in w will weakly increase V_m.*

This result follows directly from the assumption of nonsatiation. Increasing I, spousal income, will automatically push the financial budget constraint outwards. Nonsatiation implies that the woman's utility must improve since the original bundle can still be obtained. The reason that utility is only weakly increasing in w is that if the woman chooses not to work at either wage she will have the same consumption bundle, which still lies on the budget constraint, and her utility will remain unchanged

Proposition 2 *An increase in g_1 or g_2 will unambiguously cause V_w to increase.*

This result, again, follows directly from nonsatiation. Since no consumption is very bad, women on welfare have at least one child (g (0) = 0); therefore an increase in either g_1 or g_2 will shift the budget constraint outward. Hence her original bundle no longer lies on the budget constraint. These results are important because changes in these four variables affect only one of the two choices. As a result, for a girl facing the choice between marriage and work on the one hand and welfare on the other, changes in any of these four variables have unambiguous effects on the relative attractiveness of the two choices. Increases in welfare payments increase the attractiveness of welfare and hence should be associated with more women choosing welfare, while an increase in the income of potential spouses or in the woman's own wage rate unambiguously makes marriage and work more attractive.

An important question is the relevance of this model with respect to various demographic subgroups of the population. This original choice between welfare and work seems more relevant to an individual who has not yet made a choice of one path or the other - an unmarried fertile teen with no children. Although it may still be relevant to a women who has already made picked her path, if she wants to switch paths, she may not face the same wages and potential partner's income that she did as a teenager. A teenager with no children may have very different marriage and work opportunities available to her as a teenager than she will when older - especially after she has children or goes on welfare. It seems plausible that small shifts in labor market opportunities or welfare payments may

have a greater effect on a young teenage girl than on an older woman who has already made a substantial investment specific to one path or the other.

The final point is that even if u(.) is strictly increasing in both b and c and $g_2^* > p_b$ (and so $g_2 > 0$) an increase in g_1 or g_2 will not necessarily increase b. That is, even if a woman always prefers more consumption to less, and more children to fewer, and the additional welfare payment more than covers the minimum cost of an additional child, it is not immediate that increasing either the base welfare grant, g_1, or the additional payment per child, g_2, will increase the number of children a mother on welfare will choose to have. The argument is essentially similar to the argument that increasing wages does not immediately encourage the individual to work more. Having more children means she has less time for leisure. Since she cannot have more of both children and leisure, which one she chooses more of depends upon the structure of her preferences. In the same way, increasing I (partner's income) or w (the woman's own wage rate) will not necessarily lead to the woman choosing to have more children either. This is relevant because it means, depending upon the specific utility function, either a positive or a negative correlation between the illegitimacy rate (defined as the number of births per 1000 unmarried women of childbearing age) and welfare payments may be consistent with the model of a utility maximizing woman choosing between work and marriage on the one hand, and welfare on the other.

3.1 Comparative Statics of Model

To illustrate the final point that increasing benefit levels may not increase the number of children a woman on welfare would choose to have, we compute the comparative statics in a model with some additional assumptions. Consider a woman who for a given set of parameters (w, I , g_1 , g_2) chooses welfare over work and marriage. Further assume that any change in g_1 and g_2 is small so that she will not switch to choosing work instead. [14] For

[14] Because of this assumption the comparative statics discussion here is not the most appropriate forum to discuss the choice between welfare and work. However in the last section, under weaker conditions, it was established how changes in wages, partner's income and welfare payments affect the decision between work and welfare.

simplicity in the following discussion we assume that the woman wishes to consume strictly positive amounts of leisure, consumption and children - that is (b*,c*,l*) are all non-zero. For example an assumption that would guarantee this would be that her indifference curves are contained in the strictly positive orthant. We also assume that her utility function is increasing in all arguments, globally concave and twice continuously differentiable and that children are a continuous, rather than a discrete, good.[15]

Solving (2) for first order conditions and then taking total derivatives yields [See Appendix 1]:[16]

$$
\begin{aligned}
db &= -\tfrac{1}{\Delta}\left[\, u_c\, dg_2 \;+\; (dg_1 \;+\; b\, dg_2\,)\,(u_{bc} \;+\; g_2\, u_{cc} \;-\; t_b\, u_{cl}\,)\,\right] \\
dc &= -\tfrac{1}{\Delta}\left[\, u_c\, g_2\, dg_2 \;+\; (\, dg_1 \;+\; b\, dg_2\,)\,(\,-\,u_{bb} + 2\; t_b\, u_{bl} \;-\; g_2 u_{bc} \;+\; g_2\, t_b\, u_{cl} \;-\; t_b^2\, u_{ll}\,)\,\right] \\
dl &= -\,t_b\, db
\end{aligned}
$$

where

$$
\Delta \;=\; (\, u_{bb} + g_2 u_{bc} - t_b\, u_{bl}) \;+\; g_2\,(\, u_{bc} + g_2 u_{bl} - t_b\, u_{cl}) \;-\; t_b\,(\, u_{bl} + g_2 u_{cl} - t_b\, u_{ll}) \;<\; 0
$$

Note that any change in g_1 or g_2 has the opposite effect on b (number of children) and l (amount of leisure). This is because time is divided only between leisure and childbearing/childrearing and so, under this assumption, any increase in the number of children means the woman must consume less leisure.

Using these results, it is possible to make the following observation on the effect of welfare benefits on the number of children the woman will choose to have.[17]

$$
\frac{\delta b}{\delta g_1} \;=\; -\,\frac{1}{\Delta}\,[\, u_{bc} \;+\; g_2\, u_{cc} \;-\; t_b\, u_{lc}\,] \tag{6}
$$

[15] This allows families to really have 2.2 children.

[16] Because there are three arguments in the utility function, this model is difficult to solve explicitly for a demand function. For a general CES utility function there is no explicit solution, and even demands for a Cobb Douglas or CES utility function with specified parameters are rather complex

[17] We focus on this decision because it is probably the most important policy consideration that can be discussed in this framework

The change in demand for children with respect to the base welfare change depends upon the second derivatives of u (.) and on the sign of g_2.[18]

Likewise

$$\frac{\delta b}{\delta g_2} = -\frac{1}{\Delta}\left[u_c + b\left(u_{bc} + g_2 u_{cc} - t_b u_{lc}\right)\right] \tag{7}$$

Recalling that $\Delta < 0$, this gives the following proposition.

Proposition 3 *If* $\frac{\delta b}{\delta g_1} > 0$ *then* $\frac{\delta b}{\delta g_2} > 0$.

Proof: U (.) is increasing in consumption ($u_c > 0$), and the woman has a positive number of children ($b > 0$) and

$\frac{\delta b}{\delta g_1} > 0$ implies ($u_{bc} + g_2\, u_{cc}$ - $t_b\, u_{lc}$) > 0 .

As a result $u_c + b\,(u_{bc} + g_2\, u_{cc}$ - $t_b\, u_{lc}) > 0$, and so $\frac{\delta b}{\delta g_2} > 0$. □

Note that the reverse is not true. $\frac{\delta b}{\delta g_2} < 0$ implies that $u_c >$ - b ($u_{bc} + g_2\, u_{cc}$ - $t_b\, u_{lc}$); it is possible that b ($u_{bc} + g_2\, u_{cc}$ - $t_b\, u_{lc}$) < 0 and hence that $\frac{\delta b}{\delta g_1} < 0$.

The intuition behind this result is that increasing the incremental payment for additional children is more likely to increase the number of children that a woman on welfare chooses to have than an increase in the base grant. Note that it is possible that an increase in g_2, the additional grant, will work in the opposite direction from an increase in g_1, the base grant. This is important because it means that empirical work on the effects of changes in welfare benefits on the illegitimacy rate or ratio should therefore separate the effects of changes in the base and additional grants.[19]

[18] Recall that $g_2 = (g_2^* - p_b)$ and so it may be positive or negative depending upon whether the increase in welfare received is greater than or less than the minimum amount required to raise a child.

[19] If one is only interested in the number of women choosing welfare this point is less important since increases in either the base or additional grant increase the relative attractiveness of welfare. In this study we are concerned with the effects of changes in benefits on teen girls. Since most out-of-wedlock births to teen girls are first births and girls must have at least one birth to receive AFDC we are using the teen illegitimacy rate as a proxy for the number of teens choosing welfare. This would be more problematic for older women since most births out-of-wedlock to older women are second or later births.

Example 1: Cobb Douglas Preferences.

Cobb Douglas preferences are convenient, because all the cross partial derivatives are zero.

$$u(b, c, l) = \alpha_1 \log(b) + \alpha_2 \log(c) + (1 - \alpha_1 - \alpha_2) \log(l)$$

Evaluated at (b^*, c^*, l^*); the optimum , recalling that the cross partial derivatives are zero, and that $c^* = g_1 + g_2 b^*$ from (4), the budget constraint, yields:

$$\frac{\delta b}{\delta g_1} = -\left[\frac{\alpha_2}{\Delta}\right]\left[-\frac{g_2}{(g_1 + g_2 b^*)^2}\right] \quad \begin{array}{ll} < 0 & if\ g_2 > 0 \\ > 0 & if\ g_2 < 0 \end{array}$$

$$\begin{aligned} \frac{\delta b}{\delta g_1} &= -\left[\frac{\alpha_2}{\Delta}\right]\left[\frac{1}{g_1 + g_2 b^*} - \frac{g_2 b^*}{(g_1 + g_2 b^*)^2}\right] \\ &= -\left[\frac{\alpha_2}{\Delta}\right]\left[\frac{1}{g_1 + g_2 b^*}\right]\left[1 - \frac{g_2 b^*}{g_1 + g_2 b^*}\right] \end{aligned}$$

Recalling that $c^* = g_1 + g_2 b^* > 0$ and assuming that $g_1 > 0$

then $\frac{g_2 b^*}{g_1 + g_2 b^*} < 1$ and therefore $\frac{\delta b}{\delta g_2} > 0$ whatever the sign of g_2

If the additional government grant per child (g_2) decreases then the number of children a woman on welfare with Cobb Douglas preferences chooses will decrease, whether or not g_2 covers the full cost of bearing and raising a child. On the other hand if the additional government grant does cover the additional cost of raising another child ($g_2 > 0$) then decreasing the base welfare grant (g_1) may actually increase the number of children the woman chooses to have.

The intuition behind this result is that the woman is "making up" for lost income of a cut in the base welfare grant by having more children. However it is clear that decreasing either g_1 or g_2 still unambiguously makes welfare less attractive when compared to work. This example shows that it is not difficult to find examples of utility functions where an decrease in the base welfare grant may be associated with the woman choosing more, not fewer, children. It also illustrates that increases in g_2 would be more likely to induce additional childbearing than increase in g_1.

3.2 Summary of Illegitimacy Model Predictions

In summary the theoretical model makes the following predictions which can be empirically verified:

1. Increasing the size of either the base welfare grant or the additional welfare grant per child will increase the utility from the welfare option, while leaving the utility from the marriage and work option unaffected. Hence we would expect that the number of teens choosing welfare (and illegitimacy) over the traditional choice of work and marriage to increase when welfare payments rise.

2. Increasing spousal income or the woman's own wage will increase (weakly in the case of own wage) the utility of work and marriage and will leave the utility from welfare unaffected. Hence we would expect the number of women choosing welfare over the traditional choice of work and marriage to decrease as spousal income or women's wages increase.

3. Welfare payments, both the base welfare grant, g_1, and the additional welfare grant for extra children, g_2, are ambiguously related to the number of children that a woman on welfare chooses. It is also possible that changes in the base welfare grant and changes in the additional grant for extra children will have opposite effects on the childbearing decisions of women on welfare. This is important because the empirical literature has often not distinguished between g_1 and g_2 in regressions relating out of wedlock fertility to welfare payments. Empirically the effect of an increase on the additional grant for additional children, g_2, is more likely to be positive, that is it is more likely to encourage the woman to have additional children, than an increase in the base welfare grant, g_1.

4 Data and Econometric Results

4.1 Data Considerations

To test the predictions of the above model, we use aggregate state by state data for 1980 through 1989.[20] The sources and construction of the data are discussed in Appendix 3. This study concentrates upon the effects of benefit levels on teen illegitimacy rather than the effects on overall illegitimacy for the following reasons.

1. The model in the previous section discusses the effects of increases in benefit levels, wages, and spousal income on the relative attractiveness of welfare versus work or marriage. It predicts that increased wages or spousal income will reduce the relative attractiveness of welfare, whereas increased benefit levels will increase the relative attractiveness of illegitimacy. One major concern is that, under the model, a change in welfare benefits has an ambiguous effect on the number of children that a woman on welfare chooses to have. As noted in the comparative statics in Section 2, an increase in welfare benefits - especially in the base welfare grant for the first child - may cause women on welfare to want either more or less children. Hence, higher welfare payments may increase or may decrease the illegitimacy rate among women (defined as the number of births to all unmarried women per 1000 unmarried women of childbearing age). Further, the increases in the base grant and increases in additional payments for extra children may have opposite signs. However, this is less of a problem with teens since the majority of births to unmarried teens are first births rather than second or later births, and a woman needs to have at least one child to receive AFDC.[21] We use illegitimate births per 1000 unmarried teens as a proxy for the number of teens choosing welfare. The effects of changes in welfare benefits on the number of women choosing welfare is not ambiguous in the theoretical model.

[20] Hawaii and Alaska are excluded because of missing AFDC and Food Stamp data.

[21] For teens (15-19) in 1989, 77% of births to unmarried girls were first births (83% for whites and 69% for blacks). For women aged 20 or over only 36% were first births (41% for whites and 30% for blacks). Furthermore this percentage is fairly constant over the period (between 77-79%) studied.

2. The choice between the two decision paths may be different for teens who have not committed to one path or the other, and older women who have already made an investment specific to one path or the other. If there are fixed costs involved in switching from one path to the other (which were not involved in choosing the path originally), it will take a larger shift in the relative costs and benefits to encourage a woman who has already chosen one path to switch than it would for a woman who has not yet made her decision. She may find that her relative utility from work and marriage versus welfare has changed before and after being on welfare for a period of time. A woman who has already chosen welfare as a way of life may find her marriage and work opportunities very different than those available to her before she had children. The presence of children may affect how attractive potential spouses find the woman. [22]

   Having children and receiving welfare, and hence not working, may also mean that the woman's work specific human capital has depreciated. Another possibility is that the welfare system may have encouraged her to over accumulate children, relative to the number she would have chosen had she chosen the other decision path. In the same way, the choice by a woman who chooses work and marriage may also be different before and after making her choice. Large fixed financial and emotional costs may discourage divorce, and she may have accumulated work specific human capital after having worked. Although the model may be a reasonable approximation of the choice facing a teen girl trying to decide which path to follow, it seems less reasonable to assume that changes will affect older women and teens to the same degree. It may take larger shifts in relative incentives for older women to switch paths, and so aggregating across groups may be misleading.

[22] There is good reason to believe that women who are already on welfare may have diminished marriage potential. Popkin (1990), in a survey of 149 urban AFDC recipients in Chicago asked the recipients how they would support themselves if they did not receive public assistance. The question was open-ended in that the women (98% of the sample were female) were allowed to suggest more than one possible method. Only 4% proposed marriage as an alternative - this compares unfavorably with 5.4% who suggested drug dealing or prostitution. Welfare recipients may view their marriage prospects as remote.

3. Another concern is the effect that changes in the size of welfare benefits may have on the demographics of the welfare population. As Murray (1993) notes, if changes in welfare benefits change the population of women choosing welfare, and the new entrants' demand for children differs systematically from the demand for children of women already in the welfare pool, the illegitimacy rate may respond in unpredictable ways. Once again the observation that most births to unmarried teens are first births, and that women must have at least one child to receive AFDC, means this will be less of a problem when considering teen data.

Because of these concerns, the teen illegitimacy rate, defined as the number of births to unmarried girls aged 15 to 19 per 1000 unmarried girls in this age group, is the dependent variable of interest. As discussed above, this is meant to represent the rate of teen girls who have a birth outside of wedlock which, in the context of the model presented in Section 2, is intended as a proxy for the number of girls planning on choosing welfare instead of work in later life. Even as a measure of the number of teen girls having births out of wedlock, it is imperfect. Ideally the numerator would only include first births and the denominator would only include only unmarried teen girls without a prior birth. However since these data are not readily available, and because few teenagers actually do have out-of-wedlock births, and, as noted above, most out of wedlock births to teen girls are first births, it may be a reasonable proxy for the variable of interest.

A valid question is whether births only to unmarried teens or births to all teens is a better numerator. As Acs (1993) points out, the fertility of married teens may also be affected by changes in AFDC payments since AFDC provides a form of insurance in case of divorce. However it seems unlikely that changes in benefit levels will affect married teens in the same way as it affects unmarried teens. Also, including births to married teens may underestimate the effect of AFDC on illegitimate births if higher payments encourage teen girls, who have the option of marrying the father, not to do so. Because of this, these results should be interpreted as an effect on illegitimacy among teens rather than an effect on overall teen fertility. Married girls are excluded from the denominator with the intention

of excluding girls who were married prior to the beginning of the period.[23] These girls are excluded because girls who were previously married are presumed to face a slightly different problem than unmarried teens because of the high fixed costs of divorce.

The three main independent variables to be used below are: i] the AFDC and Food Stamp guarantee for a family of four with no other income, a measure of the attractiveness of welfare; ii] the hourly wage of production and non supervisory workers in manufacturing; and iii] the incarceration rate. The measure of welfare benefits is imperfect since it does not distinguish between base benefits levels and additional payments for more children. However, as noted by Moffit (1990), the payment level for a family of four is highly correlated with payments for other family sizes. Additionally, the effect of increases in either base benefit level and additional benefits unambiguously make welfare more attractive relative to work and marriage.[24] Since women's wages are not available for this sample it is unclear whether the wage variable is proxying for an increase in women's wages, or an increase in her prospective partner's income. However increases in either of these two variables will unambiguously decrease the relative attractiveness of welfare. This particular measure is used to try to capture wage trends at lower income levels. The third measure of interest is the incarceration rate. This is intended as a measure of the size of the "pool of marriageable men" (Garfinkel and McLanahan, (1986)). It has been proposed that one of the causes of the recent increases in illegitimacy in some poor communities is a decline in the number of men available as marriage partners. It seems likely that since this measure is also correlated with other factors, such as high drug use and high mortality rates, which may also be related to the decline in the pool of marriageable men. In the context of the model presented in Section 2, a decrease in the number of marriageable men may be interpreted as a decrease in the probability of marriage and hence as a decrease in expected spousal income, I.

[23] As noted in the data appendix, the estimates of the number of girls who are married are rather imprecise, however they are derived from census data and so measure the number of girls who were married in April - in the early part of the year.

[24] Although the effect on the demand for children is ambiguous, as noted in the comparative statics section, the effect on the relative attractiveness of welfare is not.

In conclusion, the predictions from the theoretical model are that wages will be negatively correlated with the illegitimacy rate among teens, welfare benefits positively correlated with the illegitimacy rate among teens, and the incarceration rate positively correlated with illegitimacy rate among teens.

Additional variables are also included as control variables. The availability of abortions is proxied by the percentage of counties in the state with an abortion provider. It seems plausible that easier access to abortion will reduce the number of births to unmarried teens. Although easier access to abortion may also encourage greater sexual activity among teen girls, it seems reasonable that only girls who would choose to have an abortion if pregnant will be encouraged by the easier access to become sexually active. Hence, although the effect on the number of teen pregnancies is likely to be positive, the effect on the teen illegitimacy rate should be negative.[25] The unemployment rate and the female unemployment rates are included as measures of the work opportunities available to teens. The infant mortality rate, a common variable in studies of fertility is also included [see for example, Shields and Tracy (1986)].

[25]Note that this is different from an increase in ease access to birth control methods. Access to birth control may encourage girls who would give birth if they become pregnant to become sexually active, as well as girls who would choose to have an abortion. As a result the effect depends upon the number of girls who switch to more effective birth control methods and the number of girls who switch from abstinence to a less reliable form of birth control. Hence the effect of easier access to birth control on both teen pregnancies and illegitimacy rates is theoretically ambiguous.

Table 2 displays the means and standard deviations of our state-level data for the period 1980-9:

Table 2: Descriptive Statistics of Variables

Variable	Mean	S.D.	Min	Max
Abortion	0.26	0.26	0.02	1.00
AFDC and Food Stamps (Monthly in 1991 $)	755.3	127.3	486.8	1058.3
Illegitimate Births per 1000 Unmarried Teens	31.08	9.32	15.41	65.32
Incarceration Rates	170.5	81.90	28.00	486.8
Hourly Wage (in 1991 $)	11.73	1.54	8.80	15.99
Female Unemployment Rate	7.16	2.29	2.30	15.10
Infant Mortality Rate	10.70	1.70	6.80	17.00
Unemployment Rate	7.06	2.38	2.40	18.00

4.2 Econometric Considerations and Modelling

There are several econometric issues which arise in the analysis of illegitimacy data.

1. As noted by Ellwood and Bane (1985) it seems plausible that the econometric model should include individual state effects. If, as Ellwood and Bane (1985) proposes, these state effects are correlated with the AFDC benefit levels, then the appropriate model is a fixed effects model. If the effects are uncorrelated, then a random effects model will be more efficient. In our empirical work below, we test for the inclusion of state and time effects, and also test whether these effects are correlated with the other variables.

2. If the left hand side illegitimacy rate is viewed as a share of teen girls in a given state who all face the same right hand side variables, then the error term is heteroscedastic. We present and compare weighted estimation results below to address this issue.

3. It seems plausible that there may be unaccounted for dynamic or time dependent relations between contemporaneous and prior illegitimacy rates. We include lags to

examine this issue as well. However, because of the relatively short time period, and the fact that including an additional lag excludes forty eight observations, we are limited in the extent to which we can analyze this issue.

The basic statistical model we estimate below is:

$$IllegitimacyRate_{it} = a_i + g_t + b'x_{it} + e_{it} \tag{8}$$

where i indexes state and t indexes time. The observations are for each state and each year between 1980 and 1989. The error consists of three components: i] a , a state effect; ii] g, a time effect; and iii] e, the's individual error. This model can be estimated using standard panel data techniques. If the state (and time) effects are uncorrelated with the x variables then a random effects model is both consistent and efficient. If they are correlated with the independent variables then the random effects model in inconsistent. The fixed effects model is consistent in either case, but it is inefficient if the state (and time) effects are uncorrelated with the independent variables.

Table 3 presents the results of five variants of equation (8).[26]

Table 3: Basic Results from Empirical Model

Regression Type:	OLS	Fixed Effects	Random Effects	Fixed Effects	Random Effects
State Effects:	(No State)	(State)	(State)	(State)	(State)
Time Effects:	(No Time)	(No Time)	(No Time)	(Time)	(Time)
Dependent Variable	Illegitimacy Rate for Teens	Illegitimacy Rate for Teens	Illegitimacy Rate for Teens	Illegitimacy Rate for Teens	Illegitimacy Rate for Teens
	[1]	[2]	[3]	[4]	[5]
AFDC and Food Stamps	-0.0192	0.0002	-0.0102	0.0207	-0.0051
(t-stat)	-5.30	0.04	-2.56	4.86	-1.48
Hourly Wage	-0.7766	-1.4508	-1.0762	-0.6458	-0.5150
(t-stat)	-3.41	-4.86	-4.16	-2.71	-2.43
Incarceration	0.0633	0.0493	0.5697	0.0108	0.0357
(t-stat)	15.61	11.65	15.00	2.98	11.37
Abortion	-0.4721	-11.9880	-8.0768	-3.4474	-6.7690
(t-stat)	-0.38	-4.62	-4.17	-1.80	-4.31
Female Unemployment	0.3809	-1.0098	-0.7730	-0.3546	-0.4888
(t-stat)	0.85	-4.27	-3.34	-2.00	-2.82
Total Unemployment	-0.1348	0.3342	0.1583	0.1926	0.1252
(t-stat)	0.32	1.54	-3.34	1.10	0.74
Infant Mortality	0.1329	-0.8680	-0.5659	0.5096	-0.2933
(t-stat)	0.67	-6.24	-4.53	0.43	-2.74
Observations	480	480	480	480	480
R^2	0.63	0.95	0.48	0.97	0.40

[26]Inference using White standard errors is similar in the extended and base model with time and state effects to the results presented here. The only significant difference is that the coefficient on hourly wages is no longer significant at a five percent level in the base model, but remains significant at the ten percent level when White standard errors are used

Column (1) presents the results from a simple OLS regression on the panel of state-year observations - this is equivalent to restricting the model to have no state and no year effects; it does include an intercept term. [27] In this case the coefficient on the AFDC and Food Stamp variable is significantly negative - that is, high AFDC payments are associated with low teen illegitimacy. Wages and Incarceration rates both are highly significant and have the expected signs. The other variables, including the abortion variable are insignificant at conventional significance levels. Columns (2) and (3) show the results from this model including state but omitting time effects. Column (2) contains the results from a fixed effects model, while column (3) contains the results from a random effects model. Columns (4) and (5) present the fixed and random effects results with both time and group effects included.

The first question is which of these models is the appropriate one. Exploiting the observation that the fixed effects formulation is consistent whether the state (and time) effects are uncorrelated with the independent variables or not, while the random effects model is only consistent (and efficient) if the state (and time) effects are uncorrelated with the independent variables, a Hausman (1978) test is used to choose between the random and fixed effect model (Greene (1993), p. 479). If the omitted state effects are correlated with the benefit level, as was argued above, then the test should reject the random effects model in favor of the fixed effects model. As shown in Table 4, the test rejects the null hypothesis that the individual (and time) effects are uncorrelated with the independent variables at conventional significance levels whether or not time effects are appropriate. Hence the correct formulation is the fixed effects models. This is consistent with the Ellwood and Bane(1985) conjecture that omitted state characteristics may be correlated with benefit levels.

[27] Due to space considerations Table 3 omits the dummy variables and the constant term in the OLS model. The entire regression result for the base model is shown in Appendix 2.

Table 4: Hausman Tests for Fixed Effects Model

Test	Hausman Statistic χ^2 (7)	Prob value
State Effects Only	61.761	0.0000
Time and State Effects	211.933	0.0000

The next question is whether including the time and state effects, just state effects or merely a constant is appropriate. Comparing columns (1), (3) and (5), the R^2 increases markedly when state effects are included. When time effects are also included, the R^2 increases but to a lesser degree, compared to the model with only state effects. A likelihood ratio test of state effects vs no state effects rejects the null of no state effects at conventional significance levels (with a χ^2 (47) statistic of 939.08) and another likelihood ratio test rejects the null of only state effects against the alternative of both time and state effects (with a χ^2 statistic (10) of 337.91). Throughout the rest of the empirical section, a fixed effects model with both time and state dummies is used.

The next step is to exclude the insignificant variables and hence the unemployment rate and infant mortality rate are excluded from the regression (they are both singly and jointly insignificant). Once these variables are omitted, all the remaining variables are significant at least a ten percent significance level. [28] Table 5 shows the results from the base fixed effects model with both time and state dummies. This model, which includes state and time dummies, AFDC and Food Stamp benefits, hourly wages, incarceration rates, and female unemployment, is referred to as the base model throughout the rest of the analysis.

The most important observations from the base model are the signs and significance of the variables. The AFDC and Food Stamp benefit levels are significantly positively correlated with the illegitimacy rates. This is consistent with the expectation that higher benefit levels encourage teen girls to give birth out-of-wedlock and choose welfare instead of work and marriage. Likewise wages are significantly negatively correlated with the illegitimacy rates. Incarceration rates are positively correlated with illegitimacy rates, and the abor-

[28] The random effects model is rejected in the base model in favor of the fixed effects model also. Furthermore the inclusion of state and time effects is also accepted.

tion variable is negatively correlated with the illegitimacy rate for teen girls. It is worth noting that the female unemployment rate remains significant in many of the models. The coefficient on the female unemployment rate is negative, which indicates that high female unemployment is correlated with low teen illegitimacy. It is hard to find a rational economic reason for this result. However, excluding this variable from the regression [Column (2)] appears to have little effect on either the signs or magnitudes of the coefficients on the other variables in this or other formulations.[29]

Table 5: Results from the Basic Model.

Regression	Fixed Effects	Fixed Effects	Fixed Effects	Fixed Effects
Heteroscedasticity Correct.	None	None	See Eq (9)	Group-wise
State Effects	State	State	State	State
Time Effects	Time	Time	Time	Time
Dependent Variables	Teen Illegitimacy Rate	Teen Illegitimacy Rate	Teen Illegitimacy Rate	Teen Illegitimacy Rate
	(1)	(2)	(3)	(4)
AFDC and Food Stamps	0.0207	0.0215	0.0176	0.0196
(t stat)	4.92	5.07	5.78	7.12
Hourly Wage	-0.6200	-0.5741	-1.1350	-0.6279
(t stat)	-2.62	-2.42	-5.43	-4.07
Incarceration Rate	0.0111	0.0113	0.0070	0.0125
(t stat)	3.08	3.12	2.52	5.47
Abortion	-3.28	-3.35	-1.35	-0.80
(t stat)	-1.73	-1.76	-0.81	-0.60
Female Unemployment	-0.1775		-0.1317	-0.2143
(t stat)	-2.41		-2.19	-4.53
Observations	480	480	480	480
R^2	0.97	0.97	0.98	0.99

[29]Taking logs of birthrates, AFDC and Food Stamp payments, hourly wages, incarceration rates, and female unemployment rates and running a log regression gives similar results. The estimated elasticities for welfare payments and wages are slightly smaller (0.36 and -0.21 respectively), but remain significant. The log of incarceration rates falls to a significance level of 11%.

We next explore the issues of heteroscedasticity and dynamic specifications. Columns (3) contain the estimates from a weighted least squares regression where the weight on the variables is:

$$w_{it} = \left(\frac{n_{it}}{\hat{p}_{it}\,(1 - \hat{p}_{it})} \right)^{\frac{1}{2}} \tag{9}$$

where:

w_{it} is the weight on the observation for state i at time t,

n_{it} is the number of girls in state i at time t, and

$\hat{p}_{it}$ is the percent of teen girls who have an illegitimate birth in state i at time t

If one views the observed teen illegitimacy rates as grouped data with each girl in state i at time t facing the same the same right hand side variables as the other girls, and one believes that the girl's decision to have a child can be modeled in a linear probability framework, then the model will exhibit heteroscedasticity of the above form [Maddala, p.29]. Since these assumptions seem fairly strong, they are not maintained throughout the rest of the analysis. However columns (3) contains the results for comparison with the base model.[30] The main difference between the results from the weighted and unweighted models is that the coefficient on abortion becomes insignificant and the coefficient on wages becomes much larger (approximately twice the initial size).

Since this form of heteroscedasticity is fairly restrictive, we test for an additional form of heteroscedasticity. It seems reasonable to assume that different states will have different variances for their individual error terms, (e in equation (9) in this section).[31] Column (4) presents the results from a feasible generalized least squares estimator of the base

[30] Results excluding the female unemployment rates are similar in both this specification and in the state group-wise heteroscedasticity specification.

[31] Testing for this form of heteroscedasticity using a form of Glesjer's Wald test confirms this hypothesis [Greene, p396]. The null hypothesis of homoscedasticity is rejected with a χ^2 (47) statistic of 130.52 at conventional significance levels. As noted above, inference in the base model [columns (1) and (2)] is similar using White standard errors.

regression correcting for group-wise heteroscedasticity. The results for all variables are remarkably similar in both magnitude and sign to the OLS results, except that the coefficient on the abortion variable becomes much smaller and insignificant at conventional levels of significance.

In the above regression, an interesting observation is that the time dummies - they are omitted in the table but shown in Appendix 2 - appear to be increasing over time. That is, even after the other variables are included, there is still evidence that the growth in teen illegitimacy over time is not being fully accounted for. One possible hypothesis is that the time dummies may be increasing uniformly over time. An F test testing the null hypothesis of a time trend places restrictions on the time dummies to make then mimic a constant time trend. The resulting F(8,418) statistic is 17.81 and so the null hypothesis of a time trend is rejected at conventional significance levels in favor of the alternate hypothesis of time dummies.

Table 6: Base Fixed Effects Model with Lagged Dependent and Independent Variables.

Regression	Fixed Effects	2SLS Fixed Effect	2SLS Fixed Effect	2SLS First Difference
State Effects	State	State	State	State
Time Effects	Time	Time	Time	Time
Dependent Variable	Teen Illegitimacy Rate	Teen Illegitimacy Rate	Teen Illegitimacy Rate	First Diff. of Illegitimacy Rate
	(1)	(2)	(3)	(4)
Lagged Teen Illegitimacy		0.1287	0.7843	0.0430
(t stat)		0.24	4.60	0.11
AFDC and Food Stamps	0.0114	0.0114	0.0104	0.0105
(t stat)	1.64	1.76	2.21	1.82
Hourly Wage	-2.1201	-1.8571	-0.3466	-0.2457
(t stat)	-4.53	-1.55	-1.54	-0.52
Incarceration Rate	0.0116	0.0111	0.0062	0.0122
(t stat)	1.62	1.57	1.93	1.98
Abortion	-3.2739	-2.8815	-0.8529	-1.2727
(t stat)	-1.77	-1.22	-0.54	-0.42
Female Unemployment	-0.2117	-0.2152	-0.2049	-0.1539
(t stat)	-2.37	-2.55	-3.48	-1.87
Lagged AFDC &Food Stamps	0.0149	0.0123		
(t stat)	2.28	0.97		
Lagged Hourly Wage	1.3522	1.1666		
(t stat)	2.82	1.29		
Lagged Incarceration Rate	-0.0007	-0.0011		
(t stat)	-0.10	-0.16		
Lagged Female Unemployment	-0.0825	-0.0621		
(t stat)	-0.94	-0.52		
R Squared	0.98	0.98	N.A.	N.A.

We next address the effect of adding lagged independent variables to the base regression. Table 6 [column (1)] displays the results from including lagged values of AFDC and Food

Stamp benefits, lagged wages, lagged female unemployment and lagged incarceration rates. [Lagged Abortion is not included because of high collinearity with Abortion]. Table 7 shows the sums of the coefficients (the long run effects) and compares them to the coefficients from the base model. The results are broadly similar to those in the base model. The table also shows the results from Wald tests, testing whether the sums of the coefficients on the variable and its lagged value are different from zero. This is equivalent to testing if the long run effect is zero. In all cases the null hypothesis that the long run effect is zero is rejected at conventional significance levels.

Table 7: Comparison of Long-Run Effects with Coefficients from Base Model.

Variable	Long-Run Effect (lagged dependent Variables)	Coefficient (Base Model)	Test Long-Run Effect is Zero χ^2 (1)	Significance Level
AFDC and Food Stamps	0.0263	0.0207	32.63	0.0000
Hourly Wage	-0.7679	-0.6458	9.02	0.0027
Incarceration Rate	0.0109	0.0108	7.84	0.0054
Female Unemployment	-0.2942	-0.3546	13.52	0.0002

As is well known, including lagged dependent variables in a fixed effects regression is problematic, because in panel data with few time periods the lagged dependent variable is correlated with the error term [Hsiao(1986)].[32] Hence, adding a lagged dependent variable biases coefficients. One way around this problem is to take first differences of equation (8) instead of the fixed effects transformation. Although the lagged first difference of the dependent variable is still correlated with the error term, the twice lagged difference of the dependent variable lagged twice is not correlated with the error term and so can be used as an instrument in a two stage least squares regression [Andersen and Hsiao (1981)]. First differencing has another advantage over the traditional fixed effects procedure because it requires the other included independent variables to merely be predetermined

[32] Asymptotically, the lagged dependent variables are still correlated with the error term if the number of individuals gets large and the number of time periods remained fixed.

for the coefficient estimates to be consistent, whereas the fixed effects procedure requires the independent variables to be strongly exogenous [Keane and Runkle (1992)]. In this context predetermined means that the independent variables must be uncorrelated with the error term and with all lags of the error. Strongly exogenous means that the variables must be uncorrelated with both leads and lags of the error, and so it is a much stronger assumption. For comparison results from a two stage least squares regression are shown [column (2)].[33] Again this requires the independent variables to be strongly exogenous to be valid instruments.

Column (2) shows results from a two stage least square fixed effects regression. Noting that the coefficients on lagged AFDC and food stamp benefits, lagged wages, lagged female unemployment and lagged incarceration rates are all individually insignificant: a Wald test is performed to test whether they are also jointly insignificant. The Wald test statistic of the null hypothesis that they are all jointly zero is distributed with a χ^2 (4) distribution and is equal to 2.10. Hence the null hypothesis is accepted at conventional significance levels.

Column (3) shows the results of omitting these variables.[34] The coefficient on the lagged dependent variable becomes quite large (0.78), and is significant at conventional levels. The coefficient on AFDC and Food Stamps remains significant at a five percent level, and the coefficient on incarceration rates remains significant at a ten percent level. The coefficient on hourly wages is only marginally significant (at a 12.5% level), and the coefficient on the abortion variable remains negative but is no longer significant at any usual level of significance.

This regression is then repeated using first differences in a two stage least squares regression.[35] The coefficient on the lagged dependent variable is much smaller than in the two stage least squares fixed effects regression, and is statistically insignificant. The

[33]The instruments are the independent variables(but not the lagged dependent variable) and lagged and twice lagged independent variables.

[34]The twice lagged independent variables are dropped as instruments.

[35]The first differenced independent variables and twice lagged first differenced dependent variable are used as instruments.

coefficient on AFDC payments is also much smaller: however it remains significant at a 7 percent level. Likewise the coefficient of incarceration rates is significant at a five percent level. The coefficients on wages and abortions still have the predicted signs but are statistically insignificant.

These results suggest that the long run effects of these variables may be larger than the short term effects estimated in earlier models. However, these results are not highly robust to small changes in the instruments used, and so one should take care when interpreting them. The coefficients on AFDC and Food Stamp benefits and incarceration rates remain significant with the theoretically predicted signs, and the signs on wages and abortions still have the correct sign although they are statistically insignificant.

4.3 Summary of Results

We summarize here the results of our econometric investigations; the base model refers to the model containing AFDC and Food Stamp benefits, hourly wages of production and non supervisory workers in manufacturing, incarceration rates, the percent of counties in a state with an abortion provider, and female unemployment rates as right hand side variables. The results from this model are as follows:

1. AFDC and Food Stamp benefits are positively related to illegitimacy. The elasticities are also fairly large. The calculated elasticities from the base model (estimated at the means of the variables) are as follows: a 1% rise in AFDC is associated with a 0.5% rise in illegitimacy among teens. Its 95% confidence interval is (0.30 , 0.71). Estimates of the (long run) elasticity from the other models range between 0.41 and 0.63. The positive relationship is robust to different model specifications.[36]

2. Hourly wages of production and non-supervisory workers are negatively related to teen illegitimacy. The elasticities estimated in the various model specifications range between -0.42 and -0.21. The estimate from the base model is - 0.23. Once again this result is fairly robust across models.

[36] We do not include the models with lagged dependent variables in these ranges because the results are fairly unstable.

3. Incarceration rates are also positively related to illegitimacy. However the effect is fairly small. The elasticity in the base model is only about 0.06. This result is consistent with the idea that this variable is proxying for a decline in marriageable men which in turn has been suggested as a potential cause of the rocketing illegitimacy rates. One problem with this measure is that it may merely reflect an overall increase in delinquent behaviors among youth rather than a decline in the pool of marriageable men. The positive relationship is also robust across models.

4. Easier access to abortion appears to be negatively related to the teen illegitimacy rate. The coefficient is difficult to interpret because of the imprecision of the proxy variable (number of counties with an abortion provider), and this may be why the result is not very robust. Although the coefficient is negative in all estimated models it is sometimes insignificant at conventional significance levels.

5. In all the models estimated, there is evidence of an increasing trend in illegitimacy not explained by the variables included in the models. This indicates that, although the variables have the signs expected from theory (except the female unemployment rates), part of the rapid growth in illegitimacy remains to be explained. One possibility is that the wage and incarceration variables may not be capturing the declining attractiveness of work and marriage, either because the measured variables have not declined as much as the opportunities available to young men and women, or that young men have become more unwilling to marry, or have become even less attractive marriage partners than the increase in incarceration rate suggests. [37] Another possibility is that the model fails to capture a transformation of public opinion regarding single mothers.

6. The inclusion of lagged dependent variables suggest the intriguing possibility that the long-run effects of variables may be far larger than the short run effects found in this model. It is possible that changes in benefits today will increase illegitimacy today

[37] See, for example, Anderson (1990) who discusses changing marriage and fertility habits in a poor urban neighborhood in a large Northeastern city. Bound and Holzer showed in the 1970s that demand shifts away from manufacturing adversely affected job opportunities for less educated black males.

and this will increase illegitimacy tomorrow through a change in attitudes. However, it should be noted that the results when lagged dependent variables were included in the regression were unstable. The two robust results were that welfare benefits and incarceration rates remained significantly positively related to illegitimacy.

4.4 Discussion and Further Implications

Both the theoretical and empirical results stress the importance of economic incentives on the choice between work and welfare. A 1% increase in welfare payments is associated with approximately a 0.5% increase in illegitimacy among teen girls, while a 1% increase in wages in associated with a 0.25% decrease in illegitimacy.

Next, the effects of changing the incentives facing teen girls is explored. Table 8 and Table 9 show the results of a hypothetical 20% cut in AFDC payments and a hypothetical 20% increase in real wages in selected states. Table 8 show that the percent changes in illegitimacy rates, resulting from a 20% cut in AFDC payments, range between -14% and -3%. In states such as Mississippi where benefits are already low and illegitimacy rates very high, the effect is much smaller than in states such as California. Table 9 shows the effect of a hypothetical rise in wages - the effects of raising real wages are a lot smaller than the effects on cutting real AFDC payments. In most states it would take a large increase in real wages to have much of an effect on the illegitimacy rates.

Table 8: Effect of a 20% Cut in 1989 AFDC and Food Stamp Payments in Selected States

State	Actual Teen Illegitimacy Rate	Est. Teen Illegitimacy Rate	Est. Rate after 20% cut in AFDC	Percent Change
California	45.22	43.85	39.60	-10%
Illinois	51.44	47.36	44.50	-6%
Iowa	29.94	29.66	26.52	-11%
Mississippi	65.32	64.76	62.74	-3%
New York	34.65	36.27	32.60	-10%
Texas	38.79	41.10	38.77	-6%
Vermont	24.33	28.99	25.04	-14%

Table 9: Effect of a 20% Rise in Real Wages in Selected States in 1989

State	Actual Teen Illegitimacy Rate	Est. Teen Illegitimacy Rate	Est. Rate after 20% Rise in Wages	Percent Change
California	45.22	43.85	42.34	-3%
Illinois	51.44	47.36	45.83	-3%
Iowa	29.94	29.66	28.19	-5%
Mississippi	65.32	64.76	63.67	-2%
New York	34.65	36.27	34.82	-4%
Texas	38.79	41.10	39.71	-3%
Vermont	24.33	28.99	27.63	-5%

Even though cutting welfare benefits may reduce illegitimacy among teens and thereby reduce future welfare dependency, the results indicate that decreasing welfare payments is not the only policy available to a government that wishes to cut dependency on public transfers.

Increasing wages at the lower end of the income distribution may be a useful way to reduce illegitimacy among teen girls. Various ways to accomplish this may include economic

reform of minimum wage laws, possibly using government as an employer of last resort, or increasing training and education among at risk teen girls. The last option could raise wages by increasing the human capital of teen girls. This, however, relies upon the girls wanting the training which may, in turn, require increasing the incentives to stay in school. The costs of these policies should be assessed, and weighed against the benefits of reducing illegitimacy since they may not be cost effective.

A further implication is the importance of focusing on community solutions to the problem of illegitimacy. Providing education and training only to girls who already have had an illegitimate birth provides perverse incentives for girls making fertility and marriage decisions. The cost of child care, as well as concerns that the time costs of raising young children may decrease human capital accumulation, may make it cost effective not to require at-risk girls to get pregnant before they can receive training. It may be less costly to try to reduce illegitimate teen births before they occur than to try to get girls who have already have given birth to join the labor force.

Given the conjecture that the rise in illegitimacy may be related to a decline in the number of marriageable men implies focusing on just girls may not be as effective as focusing on all teens. Policies designed to increase both the wages of women, and the wages of men whom they might marry may both be effective.

The theoretical section indicates that eliminating additional incremental payments for having additional children may be both an effective way to encourage fewer teens to choose welfare, and a way to decrease the number of births that the girls have if they do choose welfare. Although the model finds that the small changes in the additional incremental payment for additional children have an ambiguous marginal effect on the number of children, at least it would reduce the cost of the welfare system by reducing per recipient payments. This policy has already been adopted by the AFDC program in New Jersey.[38]

Another point that should be stressed is that the empirical results are only for teens, not for the population as a whole. As discussed above, we think it is unlikely that women

[38]In the first year of this rule, births to AFDC mothers were down a monthly average of 10.4% in New Jersey (Wall Street Journal editorial, "The $64 dollar question", March 28,1994). Other states are considering similar provisions.

already on welfare will be as responsive to small changes in welfare benefits or wages as unmarried teens with no children. This indicates that grandfathering the changes in the welfare system may be attractive since it will reduce the incentives for teens making the initial choice between work and welfare without punishing those who have already made decisions, such as whether to give birth or not, which are difficult or impossible to change. This issue is important when considering eliminating incremental payments for additional children. Women who already have children are not able to reduce the number they have already had, and so grandfathering changes may be especially important. This would make this policy more difficult to implement because of the question of what to do about people who leave and then re-enter the welfare programs. Finally, government policy towards abortion may also be important in reducing teen illegitimacy. However, this discussion is more difficult, because of the other ethical, political and moral decisions involved in abortion policy.

5 Conclusions

We have sought in this paper to develop a classical model of the teen fertility decision in the presence of public income transfers. In it, teen girls choose from the two options of either completing her education and then seeking work or getting married, or becoming a single parent and gaining access to AFDC, Food Stamps, Medicaid, and housing and energy assistance. Our theoretical model predicts that welfare payments will encourage such dependency, holding constant other economic opportunities, and that better economic opportunities will discourage dependency.

Empirically, we confirm our model's predictions. We find that:

1. Welfare benefits are strongly and robustly related to teen illegitimacy. The elasticity with respect to changes the illegitimacy rate is around +.5;

2. Wages are fairly strongly negatively related to teen illegitimacy. This result is also fairly robust and the elasticity with respect to the illegitimacy rate is around -.25;

3. Incarceration rates, used as a proxy for decreased probability of marriage, is robustly

related to teen illegitimacy. This variable is meant to represent the decrease in the pool of marriageable men that has occurred in some poor communities. As noted above the effect is statistically significant but fairly small in magnitude. These past three results are consistent with theoretical predictions.

4. Ease of access to abortion is related to teen illegitimacy, although this result is not highly robust.

A number of theoretical and empirical questions remain open and deserve further investigation. Although the coefficients on the variables have the correct theoretical signs, the variables do not entirely explain the rapid growth in illegitimacy over the past 10 years. Time dummies are highly significant and increasing over this time. Explaining this growth important: the explanation that it is due to "changes in attitudes" is intellectually unsatisfying. Explaining this growth in a more satisfactory and testable way would seem an important goal for future research. Another useful exercise would be to endogenize the marriage choice for teen girls in the theoretical model since this may help clarify empirical concerns, especially with regards to the right hand side variables.

Other useful exercises would be to extend the analysis to test the effects by year-groups and by race. Two other important goals are to improve the measure of benefits and to improve the measure of wages. Separating AFDC from Food Stamps and including a measure of the insurance value of Medicaid may be useful. Also, separating the effects of changes in the base welfare payments from the effects in changes in the incremental payments for additional children would be useful. If, as suggested earlier, the wage variable used here does not reflect the entire decline in the wages of recent high school dropouts and graduates, then improving this measure may better explain the observed growth in teen illegitimacy Further extending the analysis to older women may also be useful, although as noted above this may be more difficult to do than for teens.

Extending the research back to the seventies might also be useful. It may be difficult to accomplish this in a satisfactory way due to changes in the Food Stamp program and abortion during this time period.[39] However extending the data back further may also allow

[39]Prior to 1977, food stamp recipients were required to buy food stamps at a discount of their face value

one to better study the potentially important dynamic effects and still retain a reasonably large sample.

- this was abolished because of concerns that individuals were not always able to afford their allotments [Ohls and Beebout (1993, p16)]. Roe versus Wade in 1973 and the Hyde amendment in 1976, which ended federal medicaid funding of abortion, may also be important.

6 Appendix 1: First Order Conditions and Comparative Statics

Solving problem (2) the woman's maximization problem for a woman on welfare gives the following set of first order conditions:

$$\begin{array}{lllll}
(i) & \frac{\delta L}{\delta c} & = u_c - \lambda & = 0 \\
(ii) & \frac{\delta L}{\delta b} & = u_b + \lambda g_2 - \mu t_b & = 0 \\
(iii) & \frac{\delta L}{\delta l} & = u_l - \mu & = 0 \\
(iv) & \frac{\delta L}{\delta \lambda} & = c - g_1 - g_2 b & = 0 \\
(v) & \frac{\delta L}{\delta \mu} & = m - l - t_b b & = 0
\end{array}$$

Using (i) and (iii) to substitute the Lagrange multipliers out of the system and then taking total derivatives of the remaining first order conditions gives the following solution (all first and second derivatives evaluated at the optimum):

$$\begin{array}{rl}
(u_{bb} + g_2 u_{bc} - t_b u_{bl})\, db + (u_{bc} + g_2 u_{cc} - t_b u_{cl}) dc + (u_{bl} + g_2 u_{cl} - t_b u_{ll}) + u_c dg_2 & = 0 \\
dc - dg_1 - b\, dg_2 - g_2\, db & = 0 \\
- dl - t_b\, db & = 0
\end{array}$$

Solving for {db, dc, dl} yields

$$\begin{aligned}
db &= -\tfrac{1}{\Delta}\left[u_c\, dg_2 + (dg_1 + b\, dg_2)(u_{bc} + g_2 u_{cc} - t_b u_{cl}) \right] \\
dc &= -\tfrac{1}{\Delta}\left[u_c g_2\, dg_2 + (dg_1 + b\, dg_2)(-u_{bb} + 2 t_b u_{bl} - g_2 u_{bc} + g_2 t_b u_{cl} - t_b^2 u_{ll}) \right] \\
dl &= -t_b\, db
\end{aligned}$$

where

$$\Delta = (u_{bb} + g_2 u_{bc} - t_b u_{bl}) + g_2 (u_{bc} + g_2 u_{bl} - t_b u_{cl}) - t_b (u_{bl} + g_2 u_{cl} - t_b u_{ll})$$

$$\begin{bmatrix} 1 & g & -t \end{bmatrix} \begin{bmatrix} u_{bb} & u_{bc} & u_{bl} \\ u_{bc} & u_{cc} & u_{cl} \\ u_{bl} & u_{cl} & u_{ll} \end{bmatrix} \begin{bmatrix} 1 \\ g \\ -t \end{bmatrix}$$

Since D^2u is negative definite, by assumption, this implies that $\Delta < 0$ and therefore $-\frac{1}{\Delta} > 0$

7 Appendix 2: State, Time, and Other Coefficients of Base Model

Table 10: Coefficients of Fixed Effects "Base Model"

Variable	Coefficient	Std. Error	t-statistic	Prob: $H_O : \beta=0$
AFDC and Food Stamps	0.0207	0.0042	4.92	0.0000
Hourly Wage	-0.6200	0.2371	-2.62	0.0092
Incarceration Rate	0.0111	0.0036	3.08	0.0022
Abortion	-3.2837	1.8976	-1.73	0.0843
Female Unemployment	-0.1775	0.0737	-2.41	0.0164
Alabama	42.9915	2.8009	15.35	0.0000
Arizona	43.6634	3.1503	13.86	0.0000
Arkansas	42.3230	2.6813	15.78	0.0000
California	30.1530	4.1820	7.21	0.0000
Colorado	28.4653	3.2396	8.79	0.0000
Connecticut	19.5812	4.0403	4.85	0.0000
Delaware	38.6799	3.6781	10.52	0.0000
Florida	38.6536	2.9220	13.23	0.0000
Georgia	42.9429	2.8542	15.05	0.0000
Idaho	21.0667	3.1230	6.75	0.0000
Illinois	39.6617	3.3130	11.97	0.0000
Indiana	32.1394	3.3088	9.71	0.0000
Iowa	20.7244	3.3759	6.14	0.0000
Kansas	25.6893	3.3199	7.74	0.0000
Kentucky	32.1526	2.9637	10.85	0.0000
Louisiana	50.3846	3.2994	15.27	0.0000
Maine	24.6848	3.3457	7.38	0.0000
Maryland	35.0500	3.5243	9.95	0.0000
Massachusetts	20.3386	3.6450	5.58	0.0000
Michigan	26.3766	3.9814	6.63	0.0000
Minnesota	17.8659	3.6243	4.93	0.0000
Mississippi	58.5976	2.5627	22.87	0.0000
Missouri	34.4458	3.0809	11.18	0.0000
Montana	27.3631	3.3775	8.10	0.0000
Nebraska	23.0427	3.1316	7.36	0.0000
Nevada	26.6269	3.3519	7.94	0.0000
New Hampshire	17.6376	3.2621	5.41	0.0000
New Jersey	27.7067	3.6363	7.62	0.0000
New Mexico	45.6091	2.8887	15.79	0.0000
New York	24.9396	3.8748	6.44	0.0000
North Carolina	35.8147	2.8228	12.69	0.0000
North Dakota	18.1525	3.0874	5.88	0.0000
Ohio	33.4473	3.4536	9.68	0.0000
Oklahoma	32.1719	3.2608	9.87	0.0000
Oregon	26.5202	3.6707	7.22	0.0000
Pennsylvania	27.3094	3.3230	8.22	0.0000
Rhode Island	20.6599	3.2398	6.38	0.0000
South Carolina	43.6201	2.8185	15.48	0.0000
South Dakota	26.1625	2.9565	8.85	0.0000

[continued on next page]

Variable	Coefficient	Std. Error	t-statistic	Prob: $H_O : \beta=0$
Tennessee	38.2250	2.6631	14.35	0.0000
Texas	35.0965	2.9156	12.04	0.0000
Utah	20.0293	3.2452	6.17	0.0000
Vermont	17.1770	3.7941	4.53	0.0000
Virginia	27.2604	3.0759	8.86	0.0000
Washington	26.2476	3.9633	6.62	0.0000
W. Virginia	29.6939	3.1178	9.52	0.0000
Wisconsin	22.0990	3.7636	5.87	0.0000
Wyoming	26.5256	3.1631	8.39	0.0000
1980	-12.4935	0.6156	-20.29	0.0000
1981	-11.6938	0.5696	-20.53	0.0000
1982	-10.2978	0.5594	-18.41	0.0000
1983	-8.9782	0.5297	-16.95	0.0000
1984	-8.7564	0.4507	-19.43	0.0000
1985	-7.5045	0.4308	-17.42	0.0000
1986	-7.1286	0.4138	-17.23	0.0000
1987	-5.6339	0.3688	-15.28	0.0000
1988	-3.4623	0.3440	-10.06	0.0000
R^2	0.974109			

8 Appendix 3: Data Definitions and Sources

The sources of the data are:

Incarceration Rates

Number of sentenced prisoners in the state per 100,000 resident population. United States Department of Justice, Bureau of Justice Statistics *Sourcebook of Criminal Justice Statistics, 1991*

Abortion

Percent of Counties in a state with an abortion provider of five or more abortions. Alan Guttmacher Institute *Abortion Factbook: 1992 Edition.*

Hourly Wage.

Hourly wage of production and non supervisory workers in manufacturing. 1980-81; Bureau of Labor Statistics Bulletin 2070 "Handbook of Labor Statistics, 1986." 1982-87 Bureau of Labor Statistics Bulletin 2340 "Handbook of Labor Statistics, 1989." 1988-89 Bureau of Labor Statistics Bulletin 2411 "Hours and Earnings, States and Areas 1987-92"

Prices are inflated to 1991 prices by using the June Consumer Price Index for Urban consumers.

Infant Mortality

Deaths per 1000 infants in the first year of life. *Vital Statistics of the United States*, various years.

Unemployment Rates [both Women's unemployment and Total Unemployment]

Unemployment rate 1980 Bureau of Labor Statistics Bulletin "Geographic Profile of Employment and Unemployment" 1981 Bureau of Labor Statistics Bulletin 2175 "Handbook of Labor Statistics, 1983" 1982-89 Bureau of Labor Statistics Bulletin 2340 "Handbook of Labor Statistics, 1989"

Illegitimacy Rates

The number of illegitimate births per 1000 single girls aged 15-19.

The number of illegitimate births is from Vital Statistics of the United States, various years. The estimate of the number of single girls is calculated as follows. The number of girls in each state in the single year groups for 15 through 19 year olds is from Bureau of Census, Current Population Division estimates. These figures were corrected to be consistent with the 1980 and 1990 census population counts. The percent of girls in each year group who are single (including divorced and widowed teen girls - naturally very few girls fall into either of these categories) are calculated for each state for 1980 from data from the 1980 census. These numbers are then multiplied by the number of girls to estimate the number of single girls in each state in each year group. These numbers are then summed to get the total number of single girls aged 15-19.

AFDC and Food Stamp Benefit Sums.

The total monthly payment of AFDC and Food Stamps to a family with four members and no other income. Committee on House Ways and Means *1992 Green Book*

Figures for 1981-83 are interpolated between the 1980 and 1984 values. We also calculated the sum of the AFDC and Food Stamp benefits assuming the maximum shelter deduction and standard deduction were used when calculating Food Stamp payments for 1981-83. For the overlapping years of 1980 and 1984 the numbers we calculated were within a few dollars a month for most states. The results appear robust to using these calculated variables instead of interpolated values.

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