Bell Curves and Babies:

The Interaction between Ability, Welfare and Nonmarital Childbearing.

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I. INTRODUCTION

In 1994, Herrnstein and Murray (1994) published their controversial book, *The Bell Curve*, which argued that cognitive ability is more important than family background in explaining socioeconomic outcomes for individuals, including their educational attainment, the likelihood that they become unemployed or fall into poverty, and the probability that they become dependent upon welfare. They also reported that a woman who scored two standard deviations below the mean on the Armed Forces Qualification Test (AFQT) had a 34 percent chance of having a nonmarital birth, while a woman who scored two standard deviations above the mean had only a 4 percent chance (p. 183). Since they claimed that the AFQT measures intelligence, they interpreted their results as showing that cognitive ability has a large effect on nonmarital childbearing.

Since this time, several studies have noted that Herrnstein and Murray's (1994) methodology might result in a spurious correlation between socioeconomic outcomes and AFQT score. One criticism was that their statistical analysis did not control for many factors that might be correlated with both socioeconomic outcomes and AFQT scores, resulting in omitted variable bias. Since several papers have tested whether the inclusion of additional variables affects the correlation between nonmarital childbearing and AFQT score – and have generally found that it remains large – this paper does not devote much space to this issue. A second criticism, more directly concerned with nonmarital childbearing, is that the likelihood of a nonmarital birth might affect AFQT scores, resulting in reverse causation. The main problem with the AFQT scores used in Herrnstein and Murray's (1994) analysis is that the women in their sample took the AFQT when they were already in their late teens or early twenties. Because educational attainment might affect AFQT scores, and the likelihood of having a nonmarital birth might affect educational attainment, reverse causation is a concern, especially if unobservable factors that affect educational attainment and the likelihood of a nonmarital birth (e.g., rebelliousness) are omitted.[1] One of the goals of this paper is try to re-estimate the magnitude of the effect of ability/achievement on nonmarital childbearing after controlling for endogeneity.

Although the empirical evidence strongly suggests that high ability/achieving women are less likely to have nonmarital births, it is not obvious that this should be the case in the absence of welfare. Although high ability/achieving women might make more attractive marriage partners (e.g., they will contribute more to family income if working), they will also have higher reservation utilities for marriage (i.e., their potential earnings when single are also higher).[2] In fact, if married women are more likely to specialize in home production than single women are, and ability/achievement affects home production less than it affects wages, the gains to marriage will be lower for high ability/achieving women than for low ability/achieving women. Consequently, high ability/achieving women might be more, not less, likely to remain unmarried and to have nonmarital births, resulting in a positive, rather than a negative, correlation between ability/achievement and the likelihood of having a nonmarital birth.

One plausible explanation for the observed negative correlation is that the U.S. welfare system might affect low ability/achieving women more than it affects high ability/achieving women. Since welfare provides a guaranteed minimum income for single parent families, welfare will increase (or have no effect on) the maximum attainable utility as an unmarried parent for all women.[3] However, since welfare benefits have been low – the average monthly Aid to Families with Dependent Children (AFDC) payment was only $374 for a family of three in 1996 – welfare is unlikely to affect women with strong job and marriage prospects. Since ability/achievement might affect these opportunities, welfare should increase nonmarital childbearing among low ability/achieving women, while having little effect on high ability/achieving women.[4] Some empirical evidence supports this assertion. Herrnstein and Murray (1994, p. 194) note that only 1 percent of the women who scored in the top 5 percent on the Armed Forces Qualification Test (AFQT) went on welfare within one year of their first birth, compared to 55 percent of women in the bottom 5 percent. The second goal of this paper is to explore the effect of AFDC on women of different levels of ability/achievement.

II. EFFECT OF ABILITY/ACHIEVEMENT ON NONMARITAL CHILDBEARING.

After the publication of *The Bell Curve*, several books and papers criticized Herrnstein and Murray's (1994) findings.[5] Although most criticism focused on the authors' treatment of race and on their assertion that genes have a greater effect on intelligence than the environment does, several studies suggested that Herrnstein and Murray (1994) used an estimation technique that might result in a spurious correlation between AFQT score and nonmarital childbearing.

The first criticism was that they failed to adequately control for socioeconomic background in their analysis, potentially introducing a spurious correlation between AFQT score and nonmarital childbearing. Other than the woman's score on the AFQT, Herrnstein and Murray (1994) included only one additional variable, a measure of the socioeconomic status of the woman's parents. If omitted socioeconomic variables (e.g., coming from a single-parent household or a poor neighborhood) increase the likelihood of a nonmarital birth and negatively impact academic achievement, omitting these variables could result in a spurious correlation between AFQT score and nonmarital births. Several papers have included additional measures of socioeconomic background in their analysis, generally finding that although this decreases the size of the correlation between AFQT scores and the probability of having a nonmarital birth, the correlation remains large and statistically significant.[6]

A second criticism is that AFQT score, the measure of cognitive ability used in Herrnstein and Murray (1994) and most other subsequent analyses, might reflect factors other than native intelligence. One of the most striking problems is that education appears to affect AFQT scores, suggesting that they are a measure of scholastic achievement instead of, or in addition to, a measure of innate ability.[7] For this reason, AFQT scores are referred to as a measure of ability/achievement throughout the text.

In addition to affecting the interpretation of results, this also introduces the possibility of reverse causation. When the survey participants took the AFQT in 1980, the women, who were born between 1957 and 1964, were already aged between 15 and 23. If these women had allowed their plans concerning marriage and fertility to affect their education, reverse causation might become a problem. For example, women who took the AFQT after giving birth might have either dropped out of school or college to raise the child or have devoted less time to their studies. Herrnstein and Murray (1994) tried to control for this by excluding women who became pregnant before taking the AFQT. However, reverse causation might also be a problem for women who had yet to give birth. For example, a woman who planned on having children when young, either outside of wedlock or hoping to convince the father to marry her once she was pregnant, might allow these plans to affect her education and, therefore, her score on the AFQT.

Another potential problem that might lead to endogeneity is that it might be difficult to control for every factor that affect both AFQT scores and nonmarital childbearing decisions. For example, rebellious teenagers might be less motivated to try hard on tests such as the AFQT and be more prone to have pre-marital sex or to use birth control inconsistently.[8] If educational attainment affects AFQT scores, it is even more likely that rebelliousness would affect test scores. However, if these variables are hard to measure, endogeneity might remain a concern even after additional control variables are added.

II.1 Model

This section of the paper investigates whether endogeneity appears to affect the observed correlation between nonmarital childbearing and ability/achievement. The dependent variable is the probability that the woman has a nonmarital birth before age 22. In addition to a measure of ability/achievement, the analysis includes a standard set of control variables, similar to those used in Lundberg and Plotnick (1995).[9] The model, which is estimated using maximum likelihood probit estimation, is:

$$\text{Probability (birth before age 22)} = \alpha + \beta_i'X_i + \beta_s'X_s + \beta_a'X_a$$

where X_i is the vector of individual control variables used in Lundberg and Plotnick (1995); X_s is a vector of state-level controls, including AFDC benefits, for state of residence at age 14; and X_a is the measure of ability/achievement.

II.2 Magnitude of the effect of ability/achievement on nonmarital childbearing

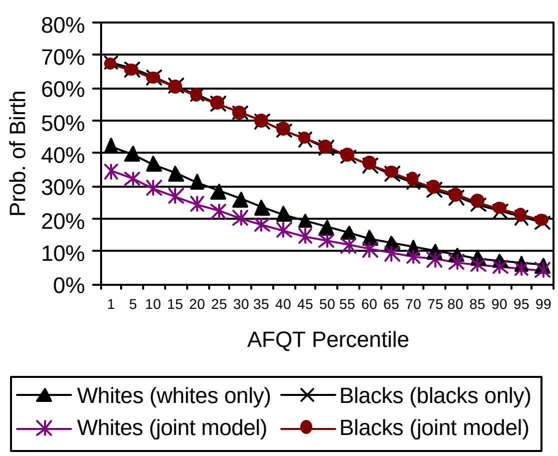

Figure 1: Probability of a nonmarital birth by age 22 for a woman born in 1964 from a mother-only family.

Note: See endnote 10.

Table 1 shows results from probit estimation of the base model. The coefficient on the woman's percentile score on the AFQT is statistically significant at more than a 1 percent significance level in all model specifications. This relationship holds for the joint sample of white and black women and for the separate (see columns 1, 2 and 3 respectively). In addition to being statistically significant at over a 1 percent level in all equations, AFQT scores have a large effect on the probability of a nonmarital birth by age 22 (see Figure 1). The probability of a white woman having a nonmarital birth by age 22 is about 11 percent if she scored in the 75th (highest) percentile on the AFQT, but over twice as high (28 percent) if she scored in the 25th percentile.[10] For a black woman, the probability is almost twice as high for women who score in the 25th percentile as it is for women who score in the 75th percentile (29 percent and 55 percent respectively).

The results appear similar, especially for black women, whether probabilities are calculated using coefficient estimates from models for blacks and whites separately or from a model pooling white and black women (see Figure 1). In fact, the null hypothesis that the coefficients on all variables other than the intercept are identical for white and black women cannot be rejected at a 10 percent significance level (χ^2 [22] = 27.38). Further, if there is a difference between white and black women, it appears that it is primarily due to different coefficients on AFDC benefits.[11] The results are robust to the inclusion of many other variables, including state fixed effects, additional family background variables, additional state controls, peer-effects variables and proxies for rebelliousness.[12]

II.3 Robustness of Results.

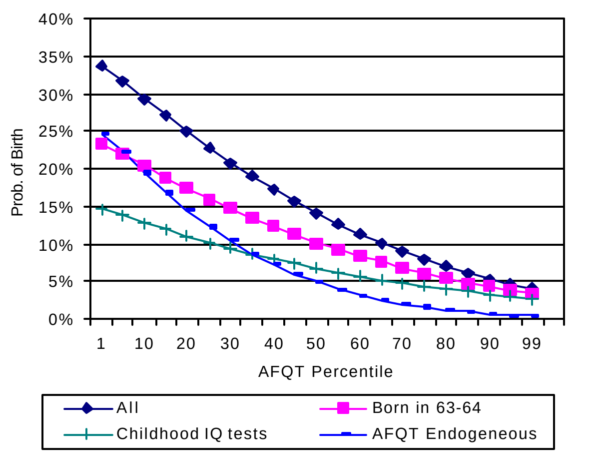

Figure 2: Probability of a nonmarital birth by age 22 for a white woman born in 1964 in a mother-only family.
Note: See endnote 10. Excludes women who gave birth before 1981.

In this sub-section, the analysis is extended using three methods to reduce the potential for endogeneity. First, the sample is restricted to the youngest women in the sample (aged 15 or 16 when they took the AFQT), who had not already given birth. These women's AFQT scores are less likely to have been affected by marriage and fertility plans. Second, instead of using AFQT scores, scores from tests of cognitive ability taken when the woman were younger are substituted for AFQT scores.[13] Future marriage and fertility plans are even less likely to affect the younger women's test scores or educational attainment and, therefore, reverse causality is even less of a concern. Finally, the model is re-estimated using childhood IQ scores to instrument for AFQT scores. This method may be preferable to using childhood IQ scores directly, since it is less likely that measurement error will bias results downwards.

Restricting the sample to women born in 1963 or 1964, who gave birth after taking the AFQT, reduced sample size dramatically. For this reason, and because nonmarital births to women under 22 are rare, the analysis is restricted to the sample of all women (i.e., it is not done separately by race).[14] Column 4 in Table 1 shows results from this sample. The coefficient on AFQT score remains statistically significant at a 1 percent level. AFQT scores have a more modest effect on the likelihood of a birth for this sample than they do for the larger sample (see Figure 2). Moving from the 75th to the 25th percentile on the AFQT increases the probability that a white woman from a mother-only family will have a nonmarital birth from 6 percent to 16 percent (see Figure 2).

Column 5 in Table 1 presents results from models with scores from childhood IQ tests replacing AFQT scores. These scores, which were collected from school transcripts, are from IQ tests taken when the women were between six and thirteen years old.[15] Since births to girls aged thirteen or younger are extremely rare, none of the women in this sample gave birth before taking these tests.[16] Further, since few girls aged thirteen or younger are contemplating having a nonmarital birth in the near future, or would have even fully mapped out their future plans regarding marriage and fertility, reverse causality is presumably even less troublesome. In general, although ability/achievement appears to have a more modest effect on the probability of a nonmarital birth when scores from childhood IQ tests are used rather than AFQT scores, the effect is still large (see Figure 2). A white woman from a mother-only family had a 10 percent chance if she scored in the 25th percentile on childhood IQ tests and a 4 percent chance if she scored in the 75th percentile.

As a final exercise, the model is estimated using childhood IQ scores as an instrument for AFQT score. One advantage of doing this model rather than including childhood IQ scores directly is that measurement error for childhood IQ (e.g., from combining results from different tests taken at different ages) is less likely to bias the coefficient on ability/achievement downward. Once more, the coefficient on AFQT score remains highly significant (see Column 6, Table 1). Further, the magnitude of the coefficient increases, suggesting that measurement error might have been a problem. Using a test proposed by Rivers and Vuong (1988), the null hypothesis that AFQT scores are exogenous cannot be rejected at conventional significance levels ($\chi^2[1] = 0.0$). The parameters from this model suggest that a white woman has a 12 percent chance if she scored in the 25th percentile on childhood IQ tests and a 2 percent chance if she scored in the 75th percentile (see Figure 2).

In summary, the correlation between ability/achievement and the likelihood of a nonmarital birth appears robust to several attempts to reduce the potential for endogeneity. Although ability/achievement has a smaller effect on the likelihood of a nonmarital birth in some cases, the effect remains large.

III. EFFECT OF AFDC ON WOMEN OF DIFFERENT ABILITY/ACHIEVEMENT LEVELS.

There are several plausible reasons for the negative correlation between nonmarital childbearing and ability/achievement. Herrnstein and Murray (1994) suggest that women that are more intelligent are more likely to weigh the costs and benefits of nonmarital births. In his critique of *The Bell Curve*, Gould (1995, p. 21) criticizes this view, suggesting that it implies that low ability women have nonmarital births because they are ‘too stupid’ to use birth control. However, another plausible explanation is that the welfare system might makes nonmarital childbearing more attractive for low ability/achieving women.

Many women who have nonmarital births do not rely upon welfare for financial support following the birth. As argued previously, it seems plausible that small changes in benefit levels will affect women who are unlikely to receive welfare benefits following a birth less than they affect women who are likely to receive benefits. For several reasons, high ability/achieving women might be less likely to receive benefits. First, to the extent that AFQT scores act as a proxy for parental resources, high ability/achieving women (especially teenagers) might be more likely to rely upon parental support if pregnant. Second, welfare might be less attractive to high ability/achieving women because they have better opportunities outside of the welfare system following a nonmarital birth.

III.1 Estimation of interaction between welfare receipt and ability.

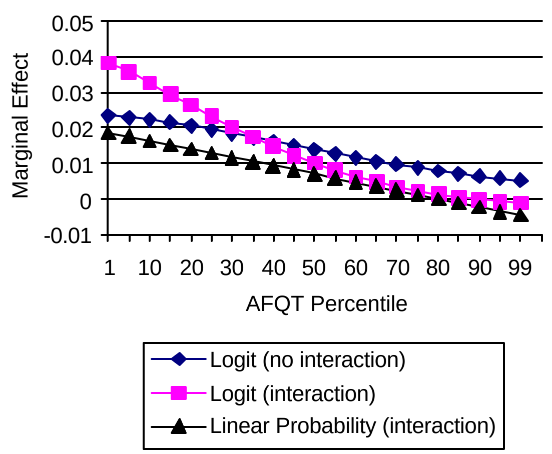

Figure 3: Marginal effect of AFDC payments for white women born in 1964 with different AFQT scores.
Note: See endnote 10

To test for the effect of welfare on women of different ability levels, a similar model to the one in the section II.1 is estimated. Since including additional variables does not affect results greatly, the control variables in this analysis are the ones in Table 1. To keep the sample size large, making it possible to estimate separate models for whites and blacks, the whole sample is included. Since the literature on the effect of welfare benefits on nonmarital childbearing usually finds stronger results for white women than for black women, separating the sample for this part of the analysis seems important. Since the null hypothesis that AFQT scores are exogenous cannot be rejected – and controlling for endogeneity does not affect results greatly – this also seems reasonable.[17]

Because Logit models are non-linear, the marginal effect of an increase in AFDC payments is different for women of different ability levels. The marginal effect of a variable entered linearly in a Logit model is (Greene, 1997, p. 876):

$$\frac{\partial E[birth \mid x_i]}{\partial AFDC} = \Lambda(\boldsymbol{b}' x_i)[1 - \Lambda(\boldsymbol{b}' x_i)]\boldsymbol{b}_{AFDC}$$

where:

$$\Lambda(\boldsymbol{b}' x_i) = \frac{e^{b' x_i}}{1 + e^{b' x_i}},$$

β is the parameter vector and x_i is the vector of control variables. Consequently, the marginal effect of a change in AFDC benefits depends upon $\Lambda(\bullet)$, which is a function of individual, family and state-level variables, including AFQT scores.

Figures 3 and 4 show the marginal probability of a nonmarital birth for white and black women, using parameter estimates from columns 2 and 3 of Table 1. Under this functional form assumption, the marginal effect of an increase in AFDC benefits is higher for low ability/achieving white women than for high ability/achieving woman (Figure 3). In contrast, the marginal effect of an increase in AFDC benefits is similar for black women of different ability levels (Figure 4).

These results, however, might be affected by the functional form assumption and, therefore, it is useful to test whether they hold under different assumptions. First, an interaction between AFDC benefits and AFQT scores is introduced into the base Logit model. Under this assumption, the marginal effect of an increase in AFDC benefits becomes:

$$\frac{\partial E[birth \mid x_i]}{\partial AFDC} = \Lambda(\boldsymbol{b}' x_i)[1 - \Lambda(\boldsymbol{b}' x_i)] \quad [\boldsymbol{b}_{AFDC} + \boldsymbol{b}_{\text{interaction}} AFQT_i]$$

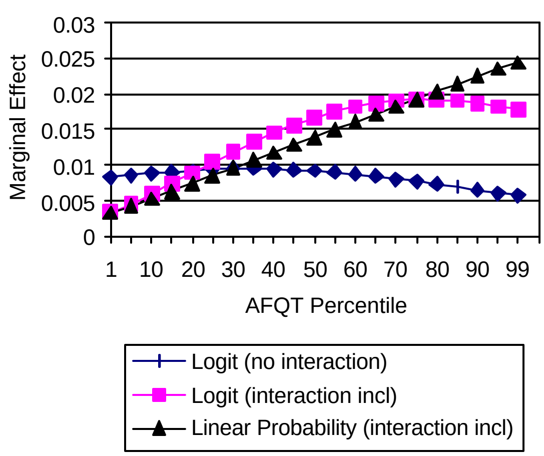

Figure 4: Marginal effect of AFDC payments for black women born in 1964 with different AFQT scores.

Note: See endnote 10

Table 2 shows results from a Logit model that includes an interaction term. When the interaction term in included for the subsample of whites, the coefficient on AFDC benefits remains positive and statistically significant, but increases in magnitude (from 0.0956 to 0.1581). The coefficient on the interaction term is negative and almost statistically significant at a 10 percent level (See Table 2, column 2). Re-estimating the marginal effect using these parameter estimates makes the marginal effect curve steeper, with benefits having little marginal effect on high ability/achieving women (see Figure 3).[18] For black women, the coefficient on the benefit variable remains positive and statistically insignificant (see Table 2, column 3). Moreover, the coefficient on the interaction term is also statistically insignificant and positive. This suggests that welfare benefits have little effect on nonmarital childbearing for either high or low ability/achieving black women. Further, the point estimates suggest that if welfare affects black women, it affects high ability/achieving women more than it affects low ability/achieving women (Figure 4) – the marginal effect of AFDC benefits appears to increase as ability/achievement increases, peaking at the 75th percentile and then slowly declining.

The model is next estimated as a linear probability model with an interaction term. Although the linear probability model might not be appropriate, results can usefully be compared with results from Logit estimation. In this model, the marginal effect of an increase in AFDC benefits is a linear function of the AFQT score:

$$\frac{\partial E[birth \mid x_i]}{\partial AFDC} = [\,\boldsymbol{b}_{AFDC} + \boldsymbol{b}_{\mathrm{int}eraction} AFQT_i\,]$$

For white women, the results are broadly similar to the results from the Logit estimation with an interaction term included. Both coefficients are statistically significant, with a positive coefficient on benefits and a negative coefficient on the interaction term. This indicates that although higher welfare benefits encourage nonmarital births among white women, the effect is smaller for high ability/achieving women. In fact, for very high ability/achieving women, the null hypothesis that welfare does not affect the likelihood of a nonmarital birth can not be rejected (see Figure 3). For black women, the coefficients on benefits and the interaction term are, again, statistically insignificant and positive. This suggests that, if benefits have any effect, the marginal effect of an increase in benefit levels is higher for high ability/achieving black women.[19]

IV. CONCLUSION

This paper shows that there is a strong correlation between nonmarital childbearing and AFQT score after controlling for endogeneity. Three methods are used to reduce the potential for endogeneity: (i) restricting the analysis to women who were 15 and 16 when they took the AFQT; (ii) replacing AFQT scores with scores from childhood IQ tests; and (iii) using childhood IQ scores as instruments for AFQT scores in FIML estimation of a two-equation system with one qualitative variable. Because the women included in the first sample were younger when they took the AFQT, and most would have been enrolled in high school, reverse causality is less of a concern for these women than for the older women used in other analyses. Using results from childhood IQ tests further reduces the likelihood of reverse causality, since future childbearing plans are even less likely to affect either performance on the IQ test or school performance for girls aged 6 to 13. Although the results from these models suggest that ability/achievement has a smaller effect on nonmarital childbearing than results from analyses including women who took the AFQT when in their late teens and early twenties, the effect remains statistically significant and large. Finally, an IV Probit system is estimated using childhood IQ scores to instrument for AFQT scores. Using childhood IQ scores as an instrument, rather than including it directly, reduces the likelihood that poor measurement of childhood IQ, which is taken from several different tests administered at different ages, will bias results downwards. Consistent with this, the results from the IV analysis suggests that ability/achievement has a greater effect on nonmarital childbearing than results including childhood IQ scores directly.

In the next subsection of the paper, the interplay between welfare, ability/achievement and nonmarital childbearing is examined. One plausible reason for the correlation between ability/achievement and nonmarital childbearing is that the welfare system in the United States encourages nonmarital childbearing among low ability/achieving women. During the period under study in this paper – and in the other papers discussed in endnote 4 – welfare benefits were only available to unwed parents and their dependent children.[20] Since welfare benefits within a given state are the same for all women, while marriage and job opportunities vary, the welfare system should be most attractive to women with relatively poor marriage and job opportunities. Consequently, if ability/achievement affected either the woman's own wages or her marriage opportunities, welfare should affect low ability/achieving women more than it affects other women.

Changes in AFDC benefits do appear to affect low ability/achieving white women more than they affect high ability/achieving white women. However, for black women, welfare does not appear to affect the likelihood of nonmarital births for either high or low ability/achieving women. In fact, if anything, the point estimates of the parameters suggest that AFDC benefits affect high ability/achieving black women more than they affect low ability/achieving black women. Although this result is puzzling, few studies have found a strong correlation between welfare and nonmarital childbearing for black women (see Clarke and Strauss, 1999).

V. REFERENCES

An, Chong-Bum; Robert Haveman and Barbara Wolfe, 1993. Teen Out-of-Wedlock Births and Welfare Receipt: The Role of Childhood Events and Economic Circumstances. *Review of Economics and Statistics* **75**, 195-207.

Becker, Gary S., 1991, *A Treatise on the Family: Enlarged Edition*, (Harvard University Press, Cambridge, Ma).

Black, Dan; Terra McKinnish and Seth Sanders, 1998. The Differential Effect of Permanent and Transitory Changes on Individual Behavior: Some Caveats about the Interpretation of Fixed-Effects and Differences Estimators. Mimeo, Carnegie Mellon University, Pittsburgh Pa.

Cawley, John; Karen Conneely; James Heckman and Edward Vytlacil, 1997. Cognitive Ability, Wages, and Meritocracy. In: Bernie Devlin, Stephen E. Fienberg, Daniel P. Resnick and Kathryn Roeder, Eds. *Intelligence, Genes and Success: Scientists Respond to The Bell Curve*. Springer-Verlag Books, New York, NY, 1997.

Clarke, George R.G. and Robert P. Strauss, 1998. Children as Income-Producing Assets: The Case of Teen Illegitimacy and Government Transfers. *Southern Economic Journal* **64** (4), 827-856.

Clarke, George R.G. and Robert P. Strauss, 1999. Did Welfare Cause the Increase in Nonmarital Childbearing in the United States? Mimeo, World Bank, Washington DC.

Devlin, Bernie; Stephen E. Fienberg; Daniel P. Resnick, and Kathryn Roeder, Eds., 1997. *Intelligence, Genes and Success: Scientists Respond to The Bell Curve*. Springer-Verlag, New York, NY.

Foster, E. Michael and Saul D. Hoffman, 1999. The Young and the Not Quite So Young: Age Variation in the Impact of AFDC Benefits on Non-Marital Childbearing. Mimeo, Georgia State University.

Gould, Stephen Jay, 1995. “Curveball” In Stephen Fraser, Ed., 1995. *The Bell Curve Wars: Race, Intelligence and the Future of America.* Basic Books, New York, NY.

Greene, William, 1997. *Econometric Analysis, 3rd Edition.* Prentice Hall, Upper Saddle River, NJ.

Herrnstein, Richard and Charles Murray, 1994. *The Bell Curve: Intelligence and Class Structure in American Life.* The Free Press, New York.

Hotz, V. Joseph; Susan Williams McElroy and Seth Sanders, 1996 The Impact of Teenage Childbearing on the Mothers and the Consequences of those Impacts for Government. In Rebecca A. Maynard, Ed. *Kids Having Kids: Economic Costs and Social Consequences of Teen Pregnancy.* Urban Institute Press, Washington DC.

Korenman, Sanders and Christopher Winship, 1995. A Reanalysis of *The Bell Curve*. NBER Working Paper No. 5230, National Bureau of Economic Research, Cambridge, Ma.

Lundberg, Shelley and Robert D. Plotnick, 1995. Adolescent Premarital Childbearing: Do Economic Incentives Matter? *Journal of Labor Economics* **13** (2), 177-200.

McKinnish, Terra G., 1999. *Model Sensitivity in Research on Welfare and Fertility*. Unpublished Dissertation, Heinz School of Public Policy and Management, Carnegie-Mellon University, Pittsburgh, Pa.

Plotnick, Robert, 1990. Welfare and Out-of-Wedlock Childbearing: Evidence from the 1980s. *Journal of Marriage and the Family* **52**, 735-746.

Rivers, Douglas and Quang H. Vuong, 1988. Limited Information Estimators and Exogeneity Tests for Simultaneous Probit Models. *Journal of Econometrics* **39** (3), 347-366.

Rosenzweig, Mark R. 1999. Welfare, Marital Prospects and Nonmarital Childbearing. *Journal of Political Economy* **107** (6), S2-32.

Winship, Christopher and Sanders Korenman, 1997. Does Staying in School Make You Smarter? The Effect of Education in *The Bell Curve*. In Bernie Devlin, Steven E. Fienberg, Daniel P. Resnick and Kathryn Roeder, Eds., *Intelligence, Genes and Success: Scientists Respond to The Bell Curve*. Springer-Verlag, New York, NY.

VI. ENDNOTES

[1] See Winship and Korenman (1997) for a discussion of the effect of educational attainment on AFQT scores.

[2] Becker (1991) presents a model of marriage where utility maximizing individuals marry when their joint household production is greater than the combined separate household production of the two individuals. If the partners can divide household production in any way, this makes gains from marriage possible.

[3] The data used in this study was from before August 1996, when Congress passed the Personal Responsibility and Work Opportunity Reconciliation Act of 1996. At this time, married couples with children were categorically ineligible to receive benefits from the main welfare program, Aid to Families with Dependent Children (AFDC).

[4] Several studies have found that AFQT scores are positively correlated with wages (e.g., Cawley et al, 1997). Further, if there is positive assortative mating, high ability/achieving women might also have better marriage opportunities (see Becker, 1991, chapter 4). Herrnstein and Murray (1994) note that the empirical evidence shows that husband and wives' IQs tend to be highly correlated (p. 110).

[5] See, for example, the collection of papers in Devlin et al. (1997).

[6] Korenman and Winship (1995) find that adding additional family background variables reduces the size of the effect, but that it remains statistically significant. Fisher et al. (1996) also find that adding additional family background and school composition variables reduces the size of the effect, but that results remains statistically significant for both white and black women. When they add years of education before taking the AFQT, the coefficient drops further and becomes statistically insignificant when comparing the likelihood of whether a first birth is nonmarital or marital (i.e., excluding women with no births). However, the coefficient remains significant when they compare having a nonmarital birth to not having one (i.e., including women with no births). McKinnish

(1999) reports that women who gave birth by age 19 had lower AFQT scores than women who reported having abortions and that both groups had lower scores than women who reported never being pregnant. Finally, Rosenzweig (1999) finds a statistically significant effect for all women, women from low-income families and black and white women. Foster and Hoffman (1999) include AFQT scores in their analysis but do not report coefficients.

[7] See Winship and Korenman (1997) and Fisher et al. (1996, Chapter 3).

[8] Fischer et al. (1996, p. 66) suggested that some individuals might have performed poorly on the AFQT because they were 'discouraged' or 'rebellious'.

[9] The estimation technique is similar to the method in Plotnick (1990). In contrast, Lundberg and Plotnick (1995) estimate a three-stage model of premarital childbearing. Due to data availability, a different measure of abortion policy is used from Lundberg and Plotnick (1995).

[10] Coefficients are from the models calculated separately for white and black women. Probabilities are calculated using the mean value of continuous variables for teens of that race. For discrete variables, the calculations assume that the woman was not brought up Baptist or Catholic, knows her mother's educational level, spoke English at home when growing up, had a mother who worked when the woman was 14, attended religious services infrequently, lived in a mother-only family at age 14, and was born outside of the South in 1964.

[11] Once the coefficients on both the intercept and AFDC benefits are allowed to be different for black women, the null hypothesis that all other coefficients are identical can not be rejected at a much lower level (χ^2 [21] = 16.55).

[12] . Results are available from the authors upon request. The percent of the woman's high school class classified as disadvantaged is included as a measure of quality of education and peer effects. Evidence of past tobacco, marijuana and alcohol use is included as a proxy for rebelliousness. Educational attainment is included in some model specifications. Most variables do not affect the size or statistical significance, with the coefficient on AFQT scores staying between –0.0101 and –0.0153 for all women, between –0.0100 and –0.0151 for white women and between –0.0100 and –0.0149 for black women.

[13] There is too little data to restrict the sample to tests taken by very young women (e.g., aged six or seven).

[14] As noted previously, the null hypothesis that the coefficients other than the intercept term are the same for black women and other women can not be rejected at conventional significance levels using the full sample.

[15] To get a reasonable size sample, scores from many different tests taken at many different ages are included in the analysis. To test the importance of this, two additional sets of dummy variables indicating the type of test taken and the age at which the woman took the test were included in regressions similar to those in Table 2. In practice, the results were nearly identical in terms of size and statistical significance.

[16] Of the 6151 women for whom data is available in the NLSY, only five gave birth when they were 13 or younger. Due to missing data, none of these women are included in the sample in this study.

[17] In this section, a Logit model is estimated rather than a Probit model, which was used in the previous section to make the results comparable to the results from the IV Probit analysis. The results in the previous section were virtually identical when Logit estimation was used rather than Probit estimation.

[18] Although the coefficient on the AFQT percentile becomes statistically insignificant in this specification, the AFQT score and the interaction term are jointly significant at less than a 1 percent level (χ^2 [2] = 134.09)

[19] As a final exercise, the model is re-estimated including state fixed effects. The results for the entire sample and black women in the Logit estimation and for all three samples in the linear probability estimation are similar. For white women in the Logit estimation, the coefficients become statistically insignificant, although the point estimates are similar to the ones in the previous table. These results are available upon request.

[20] See endnote 3.

VII. TABLES

Table 1: Probability that a woman gives birth by age 22 by race (Probit).

	(1)	(2)	(3)	(4)	(5)	(6)
Model	All women in NLSY			Women Born in 1963/1964	Childhood IQ Tests	FIML Probit – Childhood IQ Instrumenting for AFQT
Sample of Women	All	White	Black	All	All	All
# of Observations	5116	3074	1307	1002	477	466
# of States (including District of Columbia)	50	50	43	46	38	38
Cohort Dummies Included	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Ability/Achievement						
Percentile score for Armed Forces Qualification Test (AFQT)+	-0.0133*** (-11.57)	-0.0125*** (-7.91)	-0.0137*** (-6.61)	-0.0110*** (-3.77)	-0.0089*** (-2.76)	-0.0198*** (-3.16)
State-Level Controls ++						
AFDC payment for a family of 4 +++	0.0504*** (3.80)	0.0517*** (2.66)	0.0231 (1.04)	0.0378 (1.09)	0.0808** (1.97)	0.0996** (2.30)
Percentage of counties with an abortion provider	-0.2197** (-2.14)	-0.2579* (-1.80)	-0.2335 (-1.35)	-0.0933 (-0.38)	-0.7201** (-2.10)	-0.6585* (-1.87)
Individual and Family Controls						
Foreign Language Spoken at Home When Growing Up	-0.0301 (-0.33)	-0.0024 (-0.02)	-0.1775 (-0.85)	0.0568 (0.24)	-0.0241 (-0.07)	-0.1468 (-0.41)
Lived with mother only at age 14	0.4404*** (7.64)	0.6150*** (6.45)	0.3117*** (3.69)	0.5325*** (4.22)	0.1521 (0.71)	0.1225 (0.55)
Lived in 'other' family type (i.e., not both parents) at age 14	0.3549*** (5.83)	0.3302*** (3.54)	0.3856*** (3.98)	0.2183 (1.43)	0.0726 (0.28)	0.1550 (0.57)
Mother did not have job when woman was 14	0.0645 (1.36)	0.1300* (1.81)	-0.0283 (-0.37)	0.1549 (1.38)	0.0916 (0.55)	0.1098 (0.62)
Mother's education (if known)++++	-0.0307*** (-3.31)	-0.0473*** (-2.97)	-0.0304** (-1.96)	-0.0341 (-1.48)	-0.0719** (-2.10)	-0.0475 (-1.14)
Dummy indicating did not know mother's education.	-0.1759 (-1.14)	-0.4804* (-1.72)	-0.1726 (-0.73)	-0.5732 (-1.45)	0.0983*** (2.82)	
Number of Siblings	0.0353*** (4.01)	0.0418*** (2.69)	0.0408*** (3.18)	0.0180 (0.84)	0.3731* (1.76)	0.0895** (2.38)
Brought up Baptist	0.0857 (1.41)	0.0921 (0.94)	0.0366 (0.43)	0.1362 (0.95)	0.1579 (0.75)	0.3451 (1.53)
Brought up Catholic	0.0274 (0.40)	0.0326 (0.39)	-0.0873 (-0.55)	-0.0555 (-0.33)	0.2850* (1.67)	0.1414 (0.63)
Attended religious services infrequently +++++	0.1799*** (3.64)	0.1949*** (2.65)	0.2321*** (2.82)	-0.0585 (-0.47)	-0.0267 (-0.48)	0.3316* (1.85)
Age of Menarche	-0.0105 (-0.74)	-0.0463** (-2.00)	-0.0080 (-0.37)	0.0115 (0.34)	0.0489 (0.22)	-0.0014 (-0.02)
Born in South	-0.0396 (-0.60)	-0.1507 (-1.39)	-0.0105 (-0.10)	-0.1621 (-0.99)	0.7961*** (3.74)	0.1020 (0.45)
Black	0.8598*** (13.85)			0.8757*** (5.89)	0.3239 (0.75)	0.6340*** (2.65)
Hispanic	0.0573 (0.54)			0.1800 (0.70)	0.3001 (0.63)	0.4088 (0.88)
Pseudo R-Squared ++++++	0.218	0.145	0.079	0.231	0.311	---

Note" 'Mother' and 'Parents' refer to the parents of the woman (i.e., the grandparents of the baby).
* Statistically significant at 10% level. ** Statistically significant at 5% level. *** Statistically significant at 1% level.
+ For childhood IQ score is percentile score on IQ tests taken between ages 6 and 13 ++ Defined for state of residence at age 14
+++ Averaged over ages 13-20 as a measure of long-run expectations of AFDC benefits for state of residence at age 14. See Black, McKinnish and Sanders, 1998 and McKinnish, 1999.
++++ This dummy is dropped (along with the observations) when childhood IQ is included since it perfectly predicts failure in this sample
+++++ Measured in 1979 since data was not available at age 14.
++++++ Note that unlike regular R-squared terms, this pseudo R-squared term is not bounded between 0 and 1

Table 2: Probability that a woman gives birth by age 22 including interaction term between AFQT score and AFDC benefits.

	(1)	(2)	(3)	(4)	(5)	(6)
	Logit Model			**Linear Regression Model**		
Sample of Women	All	White	Black	All	White	Black
# of Observations	5116	3074	1307	5116	3074	1307
# of States (incl. District of Columbia)	50	50	43	50	50	43
Cohort Dummies Included	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
State Dummies Included	No	No	No	No	No	No
State-Level Controls +						
AFDC payment for a family of 4 ++	0.0941*** (3.13)	0.1581*** (2.92)	0.0145 (0.32)	0.0116*** (3.02)	0.0187*** (4.16)	0.0031 (0.32)
AFDC payment for family of 4 * AFQT Score	-0.0002 (-0.34)	-0.0018 (-1.63)	0.0011 (0.90)	0.0000 (-0.74)	-0.0002*** (-3.37)	0.0002 (0.89)
Percentage of counties with an abortion provider	-0.3686** (-1.99)	-0.4202 (-1.51)	-0.3778 (-1.33)	-0.0352 (-1.63)	-0.0240 (-1.16)	-0.0865 (-1.37)
Ability						
Percentile score for Armed Forces Qualification Test (AFQT)	-0.0234*** (-4.10)	-0.0104 (-1.09)	-0.0303*** (-3.44)	-0.0020*** (-3.60)	0.0001 (0.16)	-0.0062*** (-3.58)
Individual and Family Controls						
Foreign Language Spoken at Home When Growing Up	-0.0834 (-0.49)	-0.0597 (-0.27)	-0.2893 (-0.82)	-0.0120 (-0.66)	-0.0013 (-0.08)	-0.0615 (-0.84)
Lived with mother only at age 14	0.7513*** (7.51)	1.1353*** (6.50)	0.5026*** (3.65)	0.1145*** (8.22)	0.1159*** (7.15)	0.1120*** (3.62)
Lived in 'other' family type (i.e., not both parents) at age 14	0.6332*** (5.96)	0.6364*** (3.62)	0.6363*** (4.01)	0.0772*** (5.41)	0.0521*** (3.43)	0.1416*** (4.00)
Mother did not have job when woman was 14	0.1070 (1.27)	0.2392* (1.71)	-0.0415 (-0.33)	0.0226** (2.25)	0.0243** (2.40)	-0.0068 (-0.25)
Mother's education (if known)	-0.0525*** (-3.20)	-0.0901*** (-2.98)	-0.0485* (-1.91)	-0.0057*** (-2.85)	-0.0064*** (-2.85)	-0.0107* (-1.92)
Dummy indicating did not know mother's education.	-0.2921 (-1.11)	-0.8937** (-1.74)	-0.2745 (-0.71)	-0.0084 (-0.23)	-0.0672 (-1.50)	-0.0541 (-0.63)
Number of Siblings	0.0608*** (4.03)	0.0762*** (2.66)	0.0675*** (3.22)	0.0101*** (4.89)	0.0085*** (3.44)	0.0151*** (3.25)
Brought up Baptist	0.1224 (1.15)	0.1254 (0.67)	0.0486 (0.35)	0.0174 (1.27)	0.0082 (0.57)	0.0093 (0.30)
Brought up Catholic	0.0352 (0.28)	0.0583 (0.36)	-0.1728 (-0.66)	-0.0052 (-0.40)	-0.0051 (-0.43)	-0.0369 (-0.66)
Attended religious services infrequently +++	0.3205*** (3.64)	0.3698*** (2.58)	0.3795*** (2.83)	0.0348*** (3.34)	0.0276*** (2.68)	0.0862*** (2.88)
Age of Menarche	-0.0141 (-0.56)	-0.0822 (-1.87)	-0.0126 (-0.36)	-0.0020 (-0.64)	-0.0071** (-2.12)	-0.0034 (-0.44)
Born in South	-0.0735 (-0.63)	-0.3218 (-1.50)	-0.0186 (-0.11)	-0.0105 (-0.74)	-0.0186 (-1.23)	-0.0045 (-0.12)
Black	1.4836*** (13.51)			0.2458*** (16.92)		
Hispanic	0.1361 (0.70)			0.0128 (0.60)		
(Pseudo) R-Squared ++++	0.217	0.147	0.080	0.204	0.092	0.102

Note: 'Mother' and 'Parents' refer to the parents of the woman (i.e., the grandparents of the baby).
* Statistically significant at 10% level. ** Statistically significant at 5% level. *** Statistically significant at 1% level.
+ Defined for state of residence at age 14
++ Averaged over ages 12-20 as a measure of long-run expectations of AFDC benefits for state of residence at age 14. See Black, McKinnish and Sanders, 1998 and McKinnish, 1999.
+++ Measured in 1979 since data was not available at age 14.
++++ Note that pseudo R-squared terms for Logit estimation are not bounded between 0 and 1

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