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THE TIMING OF BIRTHS: IS THE HEALTH OF INFANTS COUNTER-CYCLICAL?

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ABSTRACT

This paper documents a counter-cyclical pattern in the health of children, and examines whether this pattern is due to selection of mothers choosing to give birth or due to behavioral changes. We study the relationship between the unemployment rate at the time of a baby's conception and parental characteristics (which we often refer to as quality), parental behaviors, and babies' health. Using national data from the Natality Files from 1975 onward, we find that babies conceived in times of high unemployment have a reduced incidence of low and very low birth weight and a reduced rate of neo-natal and post-neonatal mortality. These health improvements are attributable both to selection (differences in the type of mothers that conceive during recessions) and to changes in behavior during recessions. Black mothers tend to be higher quality (as measured by education and marital status) in times of high unemployment, whereas the quality of white mothers either worsens or does not improve. In the aggregate data, we find some evidence of improved behavior in times of high unemployment, but not for all mothers (use of prenatal care increases for all mothers, but smoking and drinking increase among white mothers). In order to separate out selection and behavioral effects, we use a panel of mothers from California and compare our results to those from the national aggregate data. For blacks, we find that selection drives our results, and that behavioral effects are relatively small. For whites, we find evidence of negative selection, and consequently that behavioral effects are larger than the joint behavior-plus-selection effect. Our findings are consistent with evidence that blacks are credit constrained (and therefore opt out of fertility in times of high unemployment).

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THE TIMING OF BIRTHS: IS THE HEALTH OF INFANTS COUNTER-CYCLICAL?

1. Introduction

This paper documents a counter-cyclical pattern in the health of children, and examines whether this pattern is due to selection of mothers choosing to give birth or due to behavioral changes. We study the relationship between the unemployment rate at the time of a baby's conception and parental characteristics (which we often refer to as quality), parental behaviors, and babies' health. Using national data from the Natality Files from 1975 onward, we find that babies conceived in times of high unemployment have a reduced incidence of low and very low birth weight and a reduced rate of neo-natal and post-neonatal mortality. These health improvements are attributable both to selection (differences in the type of mothers that conceive during recessions) and to changes in behavior during recessions. Black mothers tend to be higher quality (as measured by education and marital status) in times of high unemployment, whereas the quality of white mothers either worsens or does not improve. In the aggregate data, we find some evidence of improved behavior in times of high unemployment, but not for all mothers (use of prenatal care increases for all mothers, but smoking and drinking increase among white mothers). In order to separate out selection and behavioral effects, we use a panel of mothers from California and compare our results to those from the national aggregate data. For blacks, we find that selection drives our results, and that behavioral effects are relatively small. For whites, we find evidence of negative selection, and consequently that behavioral effects are larger than the joint behavior-plus-selection effect. Our

findings are consistent with evidence that blacks are credit constrained (and therefore opt out of fertility in times of high unemployment).

There is an extensive literature in demographics and economics that has documented a pro-cyclical pattern in fertility, i.e., the number of children (Yule 1906, Galbraith and Thomas 1941, Thomas 1941, Becker 1960, Silver 1965, and Ben-Porath 1973, to name but a few). Recent work by Ruhm (2000) has also documented a counter-cyclical pattern in infant mortality. The two taken together suggest one of the phenomena we explore in the paper, namely selective fertility decisions leading to a cyclical pattern in child quality. At the same time, Ruhm (2000, 2002, and 2003) and Deaton and Paxon (2001) note that health-related behavior and adult mortality are also counter-cyclical, which suggests that behavioral improvements could also play a role in cyclical quality variation. After documenting that there is cyclical variation in child quality, we will try to distinguish between these two effects.

The question we examine is important for many reasons. First, we are presenting a new stylized fact. Although there is a literature on cyclical variation in fertility (cited above), the labor market implications of variation in cohort size (e.g., Shimer 2000), and cyclical patterns in adult health and health-related behavior (Deaton and Paxson 2000; Ruhm 2000, 2003; Snyder and Evans 2002), the question of whether there is cyclical variation in the quality of birth cohorts has not been studied. Second, our results suggest that some of the previously documented declines in infant mortality during recessions (Ruhm 2000, Chay and Greenstone 2003) maybe be due to selection. Third, our results provide corroborative evidence on the extent of credit constraints in the U.S. economy. If mothers were not credit constrained, we would not expect to find significant selection

effects on child quality from changes in current unemployment. Likewise, the relative strength of these effects for blacks versus whites and married versus single mothers corroborate the view that credit constraints have important effects on individual behavior in the U.S. economy (see also Jappelli 1990). Fourth, a large literature examines the effect of postpartum household income and maternal employment on children's health and cognitive outcomes (see inter alia Shea 2000, Paxson and Waldfogel 2002, and Waldfogel, Han, and Brooks Gun 2002). We take the question back one step, and ask whether the rate of unemployment at the time of a child's conception has an impact on subsequent outcomes. Fifth, we provide a test of the Becker (1960) theory of fertility. We corroborate the role of unemployment in selective fertility decisions and document that there are important income and substitution effects that affect fertility. As such, our work is complementary to Gruber, Levine, and Staiger (1997), Angrist and Evans (1999), Donahue and Levitt (2001), and Pop-Eleches (2002), who examine the role and implications of abortion in selective fertility decisions. Finally, our work adds to the understanding of the effects of business cycles on individual behavior and points to important variations in children's health and mothers' use of prenatal care that could have policy implications, for example regarding the use of prenatal care among working women.

The paper is organized as follows. In Section 2 we provide a theoretical framework to motivate our empirical work. In Section 3, we describe the data. Section 4 presents the results from the Natality Files. Section 5 presents additional corroborative evidence. Section 6 concludes.

2. Theoretical Framework

Becker's (1960) seminal paper provides a framework within which to analyze the relationship between fertility and cyclical fluctuations in employment. Becker's key contribution is to place fertility decisions within the framework of standard price theory. In his original article, Becker discusses the implications of thinking about children as durable goods. In the context of the present study, we focus on two elements of this framework, income effects and substitution effects, and examine the implications for our empirical analysis in terms of selection and behavioral effects. By income effects we refer to changes in income when wages are held constant, whereas by substitution effects we refer to changes in wages, when income is held constant. We use the term credit constraints very generally to refer to households' inability to smooth consumption and income over time.

2.1 Income Effects

In the Becker theory, in the absence of credit constraints, fertility decisions are based on permanent, rather than transitory, income. The fertility literature, both prior to and subsequent to Becker, has instead examined the effect of short-term fluctuations – typically the unemployment rate. Becker (1960) justifies the focus on short-term fluctuations by appealing to credit constraints. Child bearing entails large, lumpy expenditures (including medical care and child-care paraphernalia), and much of this expenditure cannot be inter-temporally substituted. Losing a job (or facing an increased probability of unemployment) could lead individuals who are credit constrained to postpone childbearing, and even in the absence of credit constraints could have the same

effect for individuals whose expected duration of unemployment is long relative to their wealth (see for example Ben-Porath 1973). In other words, in Becker's theory, transitory shocks to income should have no impact on household's fertility decisions unless they are credit constrained, or unless these shocks are perceived as signaling permanent changes in the household's income.

A question that is of central interest to our analysis is which sub-groups are most likely to be affected by the business cycle. Hoynes (1999) demonstrates that blacks are more strongly affected by the business cycle than whites (i.e. they experience greater cyclical fluctuations). Jappelli (1990) documents that blacks are also more likely to be credit constrained. He also shows that the probability of being credit constrained is higher for unmarried individuals.

(A) Selection effects

We anticipate that, during times of high unemployment, credit constrained mothers will choose not to have babies, whereas the fertility decisions of mothers who are not credit constrained will not be affected. Since individuals who are credit constrained are also likely to have fewer resources to devote to their own and their children's health, selection implies a counter-cyclical pattern in the quality of children.

(B) Behavioral Effects

Income effects due to the business cycle are likely to have behavioral effects in addition to selection effects. The overall effect of these transitory income shocks on health is ambiguous. When unemployment is high, negative income effects would lead to a lower

consumption of luxury goods, which could plausibly include health-damaging goods such as cigarettes and alcohol. Lower income, however, might also reduce consumption of goods beneficial to health (such as health club memberships and nutritious diets). The work by Ruhm (2002, 2003) suggests that on average individuals are more likely to cut down on unhealthy behaviors during recessions, generating a counter-cyclical pattern in health.

2.2 Substitution Effects

The production of children is a time-intensive activity. It entails not only the time cost of pregnancy, but more generally the time associated with health-related activities. An implication of Becker's (1965) theory of time allocation is that, if individuals have flexibility and the ability to time pregnancies, they would choose to bear children when the wage rate is transitorily low (see also Ben-Porath 1973). Thus, households would respond to unemployment or to an increased probability of unemployment (that they expected to be transitory) by choosing to bear children. Substitution effects are likely to be dominant, relative to income effects, for married women, since household total income is less likely to fall among married women .[1]

(A) Selection Effects

Individuals who experience strong pro-cyclical declines in wages with the business cycle will tend to substitute into child bearing during a downturn. To the extent that lower quality women are choosing to have children, we anticipate a decline in average quality

[1] Note that this substitution effect can generate a cyclical pattern in the quality of births that is unrelated to credit constraints.

along this margin. But the opposite could also be true, that is we could observe high quality women choosing to have children in times of unemployment. The magnitude of this response depends on the elasticity of fertility with respect to wages. We have no a priori knowledge about whether high or low quality women have greater elasticities.

(B) Behavioral Effects

As we mentioned above, health-related activities are time-intensive, and as such we would expect individuals who face a transitory decline in wages to substitute into these activities. Health-related activities that benefit babies include both mother's own health (see Ruhm 2000 for evidence on adult health) and prenatal care. We examine the latter outcome in our results below.

To summarize, in response to an increase to the unemployment rate, we expect: (a) mothers who are credit constrained to delay fertility, thereby increasing the average quality of mothers and babies; (b) mothers whose wages fall to have babies (with an uncertain effect on quality); (c) all mothers to increase time-intensive health behaviors, such as exercise and use of prenatal care, most of which appear to be health improving; and (d) decreases in consumption of all normal goods (uncertain effect on health/quality depending on the type of good). Overall, the effect of unemployment on average children's health of these multiple effects depends on the relative magnitudes of income and substitution effects. These magnitudes in turn depend on: the magnitude of the correlation between mother characteristics and children's health; the magnitude of the

effect of maternal behavior on children's health; and the magnitude of women's fertility responses to unemployment.

3. Data Description and Econometric Specification

3.1 Unemployment: Data and Interpretation

We exploit variation across states and within states over time in unemployment rates. Our primary measure of unemployment is the state-by-year unemployment rate published by the Bureau of Labor Statistics. Figure 1 graphs the unemployment rate, and shows that there is considerable variation between and within states.

The unemployment rate is a widely publicized measure of the business cycle, and as such should capture not only the probability of individual job loss but also the effect of economic uncertainty more generally. Also note that given the aggregate nature of these data, we cannot distinguish between the effects of own employment and spouse (or household) unemployment.

Measurement error in the unemployment rate is an important concern. Both the number of individuals unemployed and the labor force are subject to measurement error. Thus, we also consider an alternative measure of employment, the employment-to-population ratio.

3.2 Natality Files

We use the Vital Statistics Natality records from 1975 to 1999, covering every birth in the U.S. Birth certificates contain information on parents' characteristics including age, marital status, and education, mother's behavior during pregnancy (such as prenatal care

information, and information about smoking and drinking) and child health outcomes including birth weight and the 5-minute Apgar score.[2] The sample includes all births to mothers ages 18 and older. We aggregate these data into cells defined by state of residence of the mother, year of conception, race and gender of the baby.

A few data quality issues are worth mentioning. Although all states were reporting by 1975, some states were only reporting 50% of births. It was not until 1985 that all states reported 100% of births (see Appendix A for more details). We weight our regressions using the number of births in each state to account for this differential sampling size and also because there are very few black births in some states.[3]

Most importantly, we use the date of the last menstrual period to determine the date of conception. Some states did not report this information in the early years of the panel. We therefore drop these observations.

A key variable, marital status, is imputed for most years (and is missing in some years for some states). Marital status was inferred by state by comparing the last names of the mother and the father, as reported by the mother. The codebooks indicate that this imputation method resulted in implausible marital rates for some states. Therefore, results using this variable must be taken with caution.

Both mother's education and the 5-minute Apgar score are missing in some states for the some years. Some (but not all) states report smoking and drinking after 1989. Appendix A documents variable availability for each state and year. Our regressions do

[2] The Apgar score is a 10-point scale that is used to assess the health of newborns based on five criteria (appearance, pulse, grimace, activity, and respiration) that are rated between 0 and 2. A low Apgar score has been found to be a good predictor of subsequent infant mortality. See Almond, Chay, and Lee (2002).
[3] Our results are not particularly sensitive to using weights.

not hold the sample constant: we use all of the observations available for any given specification.

We also use restricted access birth certificate data from California during the years 1990-2000, which contain enough information to identify mothers who have had more than one birth. The California birth certificate data is identical in nature to the national birth certificate data, except for the additional information it contains that allows us to convert it into a panel of mothers. There is also some information that the state of California does not collect and that is therefore not available in the California panel, such as drinking and smoking (again see Appendix A for details).[4]

3.4 Other data

We use infant mortality data provided by the Center for Disease Control (CDC). Abortion data come from both the Alan Guttmacher Institute and the CDC. The Guttmacher Institute data is believed to be more accurate but it does not break down abortions by race, which the CDC does. Note that these data do not exist for every year in our panel.

We calculate birth rates using counts from the Natality Files and population estimates provided by the Bureau of the Census online. Data on state demographics and government transfers are described in Besley and Case (2003). WIC benefits were obtained from the U.S. Department of Agriculture.

Finally, we use country-level panel data from the World Bank Indicators (available online). It contains information on infant mortality rates, birth rates, and

[4] Because of confidentiality requirements, we do not have direct access to this data. We report the results of specifications that were run for us by Roland Fryer and Steven Levitt, to whom we are very grateful for their assistance. See Fryer and Levitt (2003) for additional details regarding this data.

unemployment rates from 1980 to 2000 for all countries for which the data could be obtained.

3.5 Specification

We consider the following reduced-form specification:

$$Y_{st} = b_0 + b_1*(\text{unemployment rate})_{st} + T_t + S_s + b_{2s}(S_s*year) + e_{st}, \quad (1)$$

where Y_{st} refers to outcomes (such as mothers' characteristics, child outcomes, or use of prenatal care) for children conceived at time t, unemployment rate refers to the state-and-year specific rate of unemployment, S_s and T_t refer to state and year fixed effects, and S_s*year refers to a state-specific time trend. In some specifications we add additional state-year controls. We use the number of births as weights, and present robust standard errors, which correct for heteroskedasticity (including clustering at the state level).

Can the effect of unemployment in this specification be considered causal? Endogeneity is not the primary concern, since mothers' fertility decisions do not have an immediate and direct effect on the statewide unemployment rate at the time of conception, but it could be a concern if women leave their jobs in anticipation of future pregnancy. We address this concern by using the unemployment rate one year prior to conception as an instrument. Another concern is that the unemployment rate might capture the effect of a coincident shock or omitted variable. Our use of state and year fixed effects, and of state-specific trends, addresses some of these concerns. Our instrumental variables specification also addresses, to some extent, the concern of omitted variable bias, but more directly we add a range of time-varying controls to the specification.

Finally, we use the same specification for individual data and allow for mother fixed effects to examine the distinction between selection effects and behavioral effects.

4. Results

4.1 Introductory Results: Birth Rates and Abortion

We begin by examining the effect of unemployment on birth rates and abortion, replicating and extending previous results and laying the groundwork for our subsequent investigation of child quality.

Table 2 examines the effect of unemployment on birthrates. From previous studies (cited in Section 1), we anticipate a counter-cyclical relationship and, from our discussion in Section 2, that the effect should be larger for blacks than whites. Columns (1) and (2) confirm this. For whites and blacks, we find a negative relationship, significant at the one percent level, but the magnitude of the effect is larger for blacks than whites (a one standard deviation, that is 2 percent, increase in unemployment leads to a reduction of 12.2 percent of a standard deviation of the birthrate for blacks, compared to 9.2 percent for whites). The inclusion of state-specific trends, in columns (3) and (4), reduces the size and significance of the effect, but not the relative magnitudes. More directly, in columns (5) and (6), we show that the proportion of black babies born declines as unemployment increases. Depending on the specification, the magnitude of the effect ranges from 1.2 to 0.8 percent; both effects are significant at standard levels.

Abortion is another dimension of selective fertility, which we examine in Table 3 using data from the Guttmacher Institute and the CDC (the former is regarded as more accurate, but is not broken down by race). The results are very sensitive to the

specification we choose and to the data we employ. Even though in principle abortion is very interesting, we place little emphasis on our abortion results due to the lack of robustness of these results.[5] Taken together Tables 2 and 3 provide circumstantial evidence for increased selectivity in fertility decisions during times of higher unemployment (fewer births, more abortions), and a stronger effect for blacks. The implication of this observation, and the central thesis of this paper, is that there should accordingly be quality differences in mothers and babies.

4.2 Mother Quality, Child Health, and Prenatal Care

Tables 4a and 4b present our main results. For mother characteristics, childbirth outcomes, prenatal care, and smoking and drinking behavior during pregnancy we match outcomes to unemployment in the year of conception of the child. For mortality outcomes, we match to unemployment in the year of mortality (although results are similar when matching to one-year lagged unemployment).

In Table 4a, using the full sample, we find that increased unemployment results in a significant decreases in the incidence of low and very low birth weight and in infant mortality. Our discussion in Section 2 however, suggests that results should differ for blacks and whites—whites presumably are less subject to income effects and possibly more likely to substitute into childbearing during a downturn. The epidemiological literature also suggests that there may be significant racial differences in health. In the

[5] For example, in columns (1) to (3), for the full population and whites and blacks separately, we find that abortions per live birth increase with unemployment, although the effect is significant only for blacks. It should be noted that these results are sensitive to the specification. For example, when we examine abortions per woman, in columns (4) to (6), we find a negative effect of unemployment using the Guttmacher data, but find a positive effect for the CDC data, significant for blacks at the one percent level. (This issue is unresolved in the literature; see also Blank, George, and London 1996 and Levine 1997.) We discuss columns (7) to (10) of Table 3 in Section 5.

next rows, we split the sample by race. Once we split by race, we continue to find reduced low and very low birth weight for both races, but the effects are significant only for blacks. And we still observe significant decreases in post-neonatal mortality for both whites and blacks.

In Table 4b, we examine a range of mothers' characteristics and behaviors during pregnancy. Note that changes in indicators of behavior may reflect both selection and behavior changes. We find quality improvements for whites in terms of mother's age and father's education, but not for mother's education, although this effect is not significant. For blacks, instead, we find a much stronger and more uniform set of results: increased mother's and father's education, and older mothers.

On the other hand, for behavioral indicators for both black and whites, we find a significant increase in the use of prenatal care, a reduction in the proportion of mothers with less than five prenatal care visits, and an increase in mothers who use prenatal care in the first trimester (with almost all effects significant at the one percent level). The same is not true when we look at smoking and drinking, indicators for which we observe a sharp difference between blacks and whites. For the former group there is a reduction in these two activities (significant for drinking), and for the latter an increase in both activities (significant for smoking). Overall, our results point to a positive (counter-cyclical) quality selection for black mothers along all observable dimensions. For white mothers, the results are more mixed: we do find significant improvements in use of prenatal care but education and risky behaviors appear to worsen when unemployment increases.

Consequently, for blacks, evidence of improved birth weight and other behaviors shown in Table 4a is consistent with both a selection effect and substitution into health-improving behavior. For whites, the results are different. The statistically significant effects shown in Table 4a point to improved quality, but the smoking effect shown in Table 4b (and a negative, albeit insignificant, average education effect in Table 4a) point to reduced quality. To the extent that there is a negative selection effect along some dimensions, the results suggest that improvements for whites in health outcomes in Table 4a must be due to behavioral improvements. We confirm these speculations in Section 5.

4.3 Specification Checks

There are several factors that could confound our interpretation of the results in Table 4. Among these are the simultaneity of unemployment and outcome measures, omitted variable bias, and mis-measurement of the unemployment rate. We address each in turn.

We address the concern of simultaneity in two ways. First, it should be noted that the unemployment rate is matched by the year of conception of the child, whereas the mother and child quality outcomes are measured at birth. Unless a significant number of women exit employment in anticipation of future pregnancy, simultaneity should not be a concern. Second, we nonetheless instrument for the unemployment rate using lagged unemployment, which also addresses in part concerns of omitted variable bias. These estimates would suffer from simultaneity bias only if shocks to unemployment were correlated with shocks to fertility decisions and outcomes one to two years in the future; omitted variable bias is addressed to the extent that lagged unemployment is uncorrelated with the omitted variable in the next period. In Panel A of Table 5, we see that our result

for very low birth weight among whites is highly significant in the new specification, but otherwise the results are similar in sign, significance, and magnitude.

Another source of concern is measurement error. The unemployment rate is potentially subject to measurement error in both its numerator (unemployment) and denominator (the labor force). Thus, we consider an alternative measure of employment, namely the employment-to-population ratio. Because the employment-to-population ratio measures employment rather than unemployment, we anticipate a pro-cyclical relationship. In Panel B, we note that our results are nearly identical in direction (hence reversed in sign) to our results in Table 4. As the employment-to-population ratio increases (or as unemployment decreases) average mothers' quality declines for whites and blacks (with the exception of education for whites), and health quality deteriorates. Indeed, in this alternative specification, our results for health quality among whites babies are now statistically significant.[6] Finally, additional estimates (Appendix B) suggest that our results are also fairly robust to the inclusion of additional covariates (such as government transfers and WIC benefits), so omitted variables bias does not appear to be a major concern.

4.4 Results by Marital Status

In Table 6, we present our main results broken down by marital status. This specification serves as a further robustness check, and provides additional insight into the results from Table 4. For married white mothers, we find significant evidence of reduced quality:

[6] Another source of concern is omitted variable bias. Our results are robust to including a wide range of additional controls, such as including the age distribution of the population, average WIC benefits, percentage of the population on Medicaid, the abortion rate, and real government per capita government transfers. Many of the additional variables are significant. For unemployment our results remain highly robust in sign, significance, and magnitude.

average education decreases, and there is a significant increase in very low birth weight and a reduction in the 5-minute Apgar score. In light of our discussion in Section 2, substitution effects are likely to be stronger relative to income effects among married mothers. Since selection leads to reduced quality for married whites, the increased use of prenatal care (for two of our three measures) implies improvements in health-related behavior among married whites. For single whites, our results are similar, but weaker. Average education falls, but age increases, as does use of prenatal care. And, there are no significant effects on health measures.

Among blacks, with the exception of average father's education, our results point to uniformly improved quality for both single and unmarried mothers. However, we note that many of the effects are larger for single mothers, as would be expected if these mothers are in fact more credit constrained. Indeed, our results suggest that improvements in birth weight among blacks are driven by increases among single black mothers.

5. Corroborative Evidence and Interpreting the Results

In this section we present additional results that corroborate our findings on child quality and that provide additional interpretation.

5.1 Education and Fertility

A notable feature of our results in the previous section is the difference between blacks and whites in terms of selection, mainly shown by the average education effect (the smoking and drinking effects confound selection and behavior). We explore this finding

further in Table 7, where we examine the proportion of births that take place within four education categories (high school dropout, high school, some college, and college plus), by race. Reduced average education among white mothers is driven by an increased proportion of births among high school and high school dropout mothers, and a decrease in the proportion of births among mothers with more than high school education. In contrast, among blacks we find the opposite profile, although none of the effects appear to be significant: there is a decrease in the share of black babies born to mothers with a high school degree or less, an increase in the share of those born to mothers with some college, and finally an (unexpected) decrease among college-plus mothers (but the decrease is much smaller in magnitude than the decline for high school dropouts).

5.2 Education and Abortion

Another dimension along which selection effects can operate is abortion. In Table 3, columns (7) to (10) we examine whether the effect of unemployment on abortion varies with the proportion of mothers with more than high school education. In columns (7) and (8), for the abortion rate, we note that for both whites and blacks a higher level of education is associated with more abortions. Though not statistically significant, it is notable that the unemployment-education interaction is positive for whites and negative for blacks. For abortions per live birth, columns (9) and (10), we find that the interaction effect is negative for both whites and blacks, but much larger in magnitude for blacks. Given the limited number of observations, it is not surprising that these results are not statistically significant, but they do provide some corroboration of our finding in Section

4 that education quality increases among black mothers, but decreases among white mothers.

5.3 Unemployment Effects and Credit Constraints

As discussed in Section 2, credit constraints provide a rationale for why current unemployment could affect fertility decisions. The fact that that our results are stronger for blacks than whites, and for single mothers than for married mothers, provides circumstantial evidence of this, since we know that blacks and single mothers are more likely to be credit constrained than whites and married mothers. In this section, we provide additional evidence in favor of this view.

In particular, if the unemployment effect were due to credit constraints, then we would predict that the magnitude of the effect should be smaller in states with a lower level of credit constraints. We use state per capita transfers as a proxy for credit constraints, with the view that state transfers offset, to some extent, individual credit constraints.[7] We rank states according to their level of transfers (by regressing state per capita transfers on state and year fixed effects and labeling states with above-median state dummies as high-transfer states), and then interact the high-transfer dummy with the unemployment rate.

The results are presented in Table 8. With few exceptions, the direct effect of unemployment and the unemployment-high-transfer interaction have opposite signs, corroborating the credit constraint interpretation of our results. It is also striking that the transfer effect is significant mainly for whites. One possible interpretation is that whites

[7] We are not interested in the effect of transfers *per se* or of any particular transfer, but instead use the generosity of a state's transfers as a proxy for the level of credit constraints that households face.

are able to use transfers as a buffer in times of high unemployment, whereas blacks are either unable to access transfers or more like are already accessing transfers in times of low unemployment and not able to further extend their benefits when unemployment is high.

Overall, we interpret the results in this section from births, abortions and transfers as suggesting that less educated black women have relatively fewer babies during recessions, possibly because they are credit constrained. On the other hand the results suggest that less educated white mothers have relatively more babies during recessions, possibly due to substitution effects that are stronger than the effects of credit constraints.

6. Extensions

6.1 Nature vs. Nurture: An Examination Using California's Linked Birth Certificate Records

An open question thus far is whether counter-cyclical quality improvements are due to behavioral changes or purely to selection. For whites, the evidence suggests that behavior may play a role, given that we observe significant decreases in mortality in spite of evidence of a reduction in average mother quality (namely, education). For blacks however, all health improvements could be due to pure selection.

In order to examine this question more closely we use individual level data from California's Birth Certificate records. Using restricted versions of the yearly data, it is possible to construct a panel of mothers from 1990 to 2000, and link mother's county of residence with county level unemployment rates in the year of conception. Using this data we can test the nature versus nurture hypothesis by comparing cross-sectional

estimates of the effect of unemployment with estimates that include mother fixed effects. If the protective effect of unemployment on children's health persists after the inclusion of mother fixed effects, we can conclude that part of the health benefits associated with recessions are due to the change in behavior associated with a recession, rather than with just a change in the type of women that gave birth.

In Table 9a, we begin by estimating regressions that are identical to those we estimate at the state/year level, including all mothers in the California data, to check whether the results in the California data mirror the national results presented above. We compare the estimates from California to the main national estimates in Table 4. A priori, there are several reasons why the magnitudes of the effects could differ: the effects of unemployment could be smaller for California mothers (for example, there could be fewer credit constraints in California relative to other states); the effects of changes in county-level unemployment could be different from the effects of changes in state-level unemployment (for example, changes at the state level could be better predictors of changes in permanent income); there is possibly more measurement error in these local unemployment rates; and finally, the California data cover a later period (when again credit constraints could be smaller). We observe improvements in birth weight of similar or larger magnitude to the national numbers, but they are statistically significant only for white mothers when county specific trends are included. Prenatal care use significantly improves among all California mothers, but the magnitude of the effects is much smaller than at the national level. We conclude that the results using the California sample are qualitatively similar to those we obtain in the national sample.

In Table 9b we estimate cross-sectional estimates but now we restrict the sample to mothers who are observed at least twice in the California birth certificate data. We consider this sample to examine whether the effects of unemployment are different for mothers with multiple births. The evidence in Panel A of Table 9b suggests that the effect of the unemployment rate is similar for black mothers observed once and for those observed twice, but again the magnitudes of the effects are somewhat different. Among white mothers, however, there is evidence of negative selection effects in the birth weight outcomes which we did not observe in the national sample: we find that increases in unemployment raise the probability of having a low or very low birth weight infant even though we still observe, as in the national sample, that use of prenatal care improves.

In Panel B of Table 9b we present the results using the multiple birth sample now including mother fixed effects. The effects of unemployment therefore are estimated from changes overtime within mothers, rather than across mothers as in panel A. Comparing results from panel A and panel B, we find that for whites (once we control for selection, that is once we add fixed effects) the negative effect of unemployment on birth outcomes becomes much smaller, but the effects on prenatal care use increase. These results imply that among white mothers behavior improves in times of high unemployment but negative selection also increases, so that the net effect on infant health depends on the relative magnitude of these two effects. By extension, at the national level, it would therefore seem that the positive effect of behavioral changes is larger than the negative effect of selection, so that health outcomes improve.

Among blacks we find that the magnitude of the effect of unemployment on health outcomes and prenatal care use falls once we include mother fixed effects. This is

consistent with positive selection. Because all coefficients are insignificant when fixed effects are included, we cannot rule out that among black mothers in California, all health improvements associated with increased unemployment are due to selection. However, we must keep in mind that the sample of black mothers is much smaller in California than at the national level, especially once we restrict our attention to mothers observed twice. So these results would suggest that at the national level improvements in health outcomes among black babies are likely due to selection but possibly also due to better mother behavior.

6.2 How General Are Our Findings? Results Using Cross-Country Data

Finally, we conclude by examining whether results similar to those we have found for the United States exist for other countries. In Table 10, we examine the relationship between unemployment and the birth and infant mortality rates across a panel of countries (using data from the World Bank Development Indicators database). In columns (1) to (4), we find a negative and statistically significant relationship between both contemporaneous and lagged unemployment and the birth and mortality rates. Given the size of the data set, and the scope of the present study, it is difficult to control for many additional factors that could confound our interpretation of the unemployment effect. However, in columns (5) and (6) we show that even controlling for birthrates, which might capture country-specific, time-varying improvements in health and living standards, the unemployment effect remains significant. Interestingly, note that the coefficient on birth rates is positive and significant. Taken at face value, this correlation is consistent with the evidence presented for blacks in the United States, namely that when more babies are born, they

tend to be less healthy on average. Finally, in columns (7) and (8) we show that the adult death rate is not significantly associated with unemployment, thereby plausibly ruling out general improvements in healthcare as a confounding factor in the previous columns.

There are several important problems that exist with these preliminary cross-country results, and addressing these concerns, we feel, is beyond the scope of the present paper. Nonetheless, we note that the results we obtain using this cross-country panel data are consistent with our findings from the United States.

6. Conclusion

In this paper we have examined whether the business cycle induces a cycle in the quality of children. Within the Becker fertility framework, we argue that women who are credit constrained or more generally experience an income effect due to changes in current unemployment are both more likely to opt out of fertility in times of high unemployment and to produce less-healthy children. This effect implies a counter-cyclical pattern in child quality. On the other hand, because of time substitution effects, women whose wages fall are more likely to opt into fertility when the value of their time is low. If this effect differs across socio-economic status groups, then the substitution effect will also lead to a pattern in the quality of babies, although the direction of this effect will depend on which groups are more sensitive to the substitution effect over the business cycle. Recessions also affect individual behavior. In particular, changes in income and wages affect mothers' use of health-related goods and services.

Using the Natality Files, we find evidence for these effects. Along the dimension of selection, we find that less educated single black mothers are less likely to have babies

during recessions, raising the average health of black babies, and that less educated white mothers are more likely to have babies during recessions, leading to reduced average quality among whites. This result is consistent with evidence that blacks are more likely to be credit constrained than whites. Consequently, among blacks we observe income effects, and among whites (for whom the income effect is weak) we observe substitution effects.

We find that, when unemployment is high, neonatal and post-neonatal mortality decline, and all mothers tend to increase their use of prenatal care. We also find evidence of decreases in risky behavior, such as drinking and smoking, among blacks but increases in these activities among whites. Because of the aggregate nature of these results, our effects on behavior-outcomes capture both selection and pure behavioral changes. In particular, among blacks, since there is improved quality, both selection and behavior lead to improved behavior-related outcomes. On the other hand, among whites negative selection offsets behavioral improvements. Our results from a panel of California mothers allow us to parse out these two effects. For blacks, we find that selection drives our results, and that behavioral effects are relatively small. For whites, we find evidence of negative selection, and consequently that behavioral effects are larger than the joint behavior-plus-selection effect. We also show that our results are robust to a wide range of specifications and controls, and finally we provide evidence suggesting that these relationships seem to hold for cross-country data.

Our results are interesting for several reasons. First, our main finding – a cyclical pattern in the quality of babies – is a new stylized fact for the fertility and health literatures. Second, our results lead to a reevaluation of some of the previously

documented improvements in child health during downturns. For blacks, we show that all of these improvements are plausibly due to selection, whereas for whites, because of negative selection, the pure behavioral effects are even larger than suggested by the aggregate data. Third, our results lend support to the Becker fertility framework. Although many papers have been written regarding fertility decisions by women within the context of the legalization (or prohibition) of abortion, we provide strong evidence that women also engage in selective fertility decisions on the margin of economic uncertainty and the business cycle. Fourth, our results provide an important qualification for a large literature that has used variation between birth cohorts to analyze a range of labor market phenomena (for example, cohort size and wages). We have shown that cohorts vary not only in size, but also in quality, and that this variation is systematically related to the business cycle.

What are the policy implications of our findings? First, these results suggest that, as in Jappelli (1990), there are significant credit constraints within the U.S. economy, especially for blacks. Furthermore these credit constraints results in sub-optimal fertility decisions since women's fertility choices would differ in the absence of these constraints. Second, our findings with respect to behavioral changes induced by unemployment also raise interesting issues. Given that women's health behavior improves with higher unemployment rates and that incomes are lower, it would seem that the opportunity cost of time is an important consideration in these behavioral changes. If, as many have suggested, improving birth outcomes should be a policy target, then our results suggest that policies attenuating the effect of taking time off work to attend prenatal care, and to attend to health more generally, are particularly important.

A number of issues remain open. One interesting question in light of our findings in this paper is whether inter-state migration might contribute to our results (for example if more educated mothers are more likely to migrate from high to low unemployment states). Provisional findings using the 2000 Census in fact suggest that migration does not explain away our results, but this is an interesting and important issue worthy of further study. Another important extension is to examine whether the selection and behavioral effects we have documented affect longer-term outcomes. These are avenues for future research.

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Appendix A

State	*Year started 100% reporting*	*Educational attainment of parents*	*Date last normal menstrual period began (LMP)*	*Prenatal care information*	*Legitimacy status. Marital status*	*5-minute Apgar score*	*Drinking while pregnant*	*Smoking while pregnant*
Alabama	1976	1976-	1976-	1976-	1975-	1978-	1989-	1989-
Alaska	1977	1975-	1975-	1978-	1975-	1978-	1989-	1989-
Arizona	1985	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Arkansas	1980	1978-	1978-	1978-	1975-	1978-	1989-	1989-
California	1985	1978, 1989-	1975-	1975-	1989-	reported only 1978	Never	Never
Colorado	1973	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Connecticut	1979	1975-	1982-	1975-	1989-	1982-	1989-	1989-
Delaware	1985	1975-	1975-	1975-	1975-	1989-	1989-	1989-
District of Columbia	1985	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Florida	1972	1975-	1975-	1975-	1975-	1979-	1989-	1989-
Georgia	1985	1975-	1975-	1975-	1980-	1980-	1989-	1989-
Hawaii	1979	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Idaho	1977	1978-	1978-	1978-	1978-	1978-	1989-	1989-
Illinois	1974	1975-	1975-	1975-	1975-	1979-	1989-	1989-
Indiana	1978	1975-	1975-	1975-	1975-	1978-	1989-	1999-
Iowa	1974	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Kansas	1974	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Kentucky	1976	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Louisiana	1975	1975-	1975-	1975-	1975-	1982-	1990-	1990-
Maine	1972	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Maryland	1975	1975-	1975-	1975-	1989-	1979-	1989-	1989-
Massachusetts	1977	1975-	1976-	1976-	1978-	1978-	1989-	1989-
Michigan	1973	1975-	1975-	1975-	1975-1977, 1989-	1978-	1989-	1989-
Minnesota	1976	1975-	1975-	1975-	1975-	1982-	1989-	1989-
Mississippi	1979	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Missouri	1972	1975-	1975-	1975-	1975-	1978-	1989-	1989-

Appendix A continued

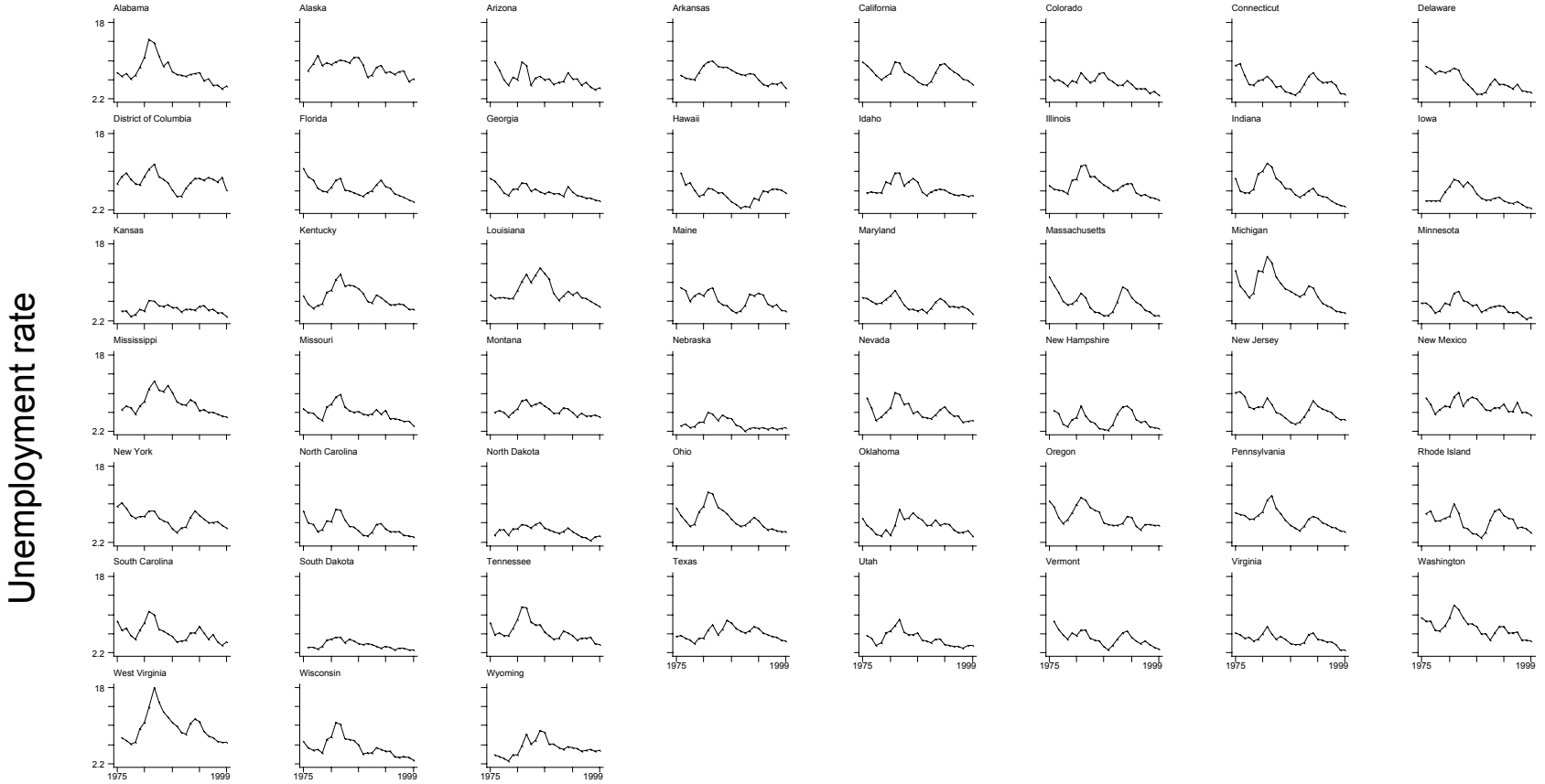
State	*Year started 100% reporting*	*Educational attainment of parents**	*Date last normal menstrual period began (LMP)*	*Prenatal care information*	*Legitimacy status--Marital status*	*5-minute Apgar score*	*Drinking while pregnant*	*Smoking while pregnant*
Montana	1974	1975-	1975-	1975-	1988-	1978-	1989-	1989-
Nebraska	1974	1975-	1975-	1975-	1975-	1978-	1990-	1990-
Nevada	1976	1975-	1975-	1975-	1989-	1978-	1989-	1989-
New Hampshire	1972	1975-	1975-	1975-	1975-	1978-	1989-	1989-
New Jersey	1979	1975-	1975-	1975-	1975-	1978-	1989-	1989-
New Mexico	1985	1980-	1985-	1980-	1980-	1980-	1989-	1989-
New York	1973	1975-	1975-	1975-	1989-	1978-	1995-	1995-
North Carolina	1975	1975-	1975-	1975-	1975-	1978-	1989-	1989-
North Dakota	1985	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Ohio	1977	1975-	1975-	1975-	1989-	1978-	1989-	1989-
Oklahoma	1975	1975-	1975-	1975-	1975-	1991-	1991-	1991-
Oregon	1974	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Pennsylvania	1979	1976-	1978-	1978-	1975-	1978-	1989-	1989-
Rhode Island	1972	1975-	1975-	1975-	1975-	1978-	1989-	1989-
South Carolina	1974	1975-	1975-	1975-	1975-	1978-	1989-	1989-
South Dakota	1980	1975-	1975-	1975-	1975-	1978-	Never	Never
Tennessee	1975	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Texas	1976	1989-	1980-	1975-	1975-1976, 1989-	never reported	1989-	1989-
Utah	1978	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Vermont	1972	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Virginia	1975	1975-	1978-	1978-	1975-	1978-	1989-	1989-
Washington	1978	1992-	1975-	1975-	1975-	1980-	1989-	1989-
West Virginia	1976	1975-	1975-	1975-	1975-	1978-	1989-	1989-
Wisconsin	1975	1975-	1978-	1975-	1975-	1978-	1989-	1989-
Wyoming	1979	1975-	1975-	1975-	1975-	1978-	1989-	1989-

Appendix B: Effect of Unemployment by Race, 1976-1996: Specification checks

Dependent variable	(1) Average mother's education	(2) % moms less high school	(3) Average mother's age	(4) Average father's education	(5) % married	(6) % born below 2500 grams	(7) % born below 1500 grams	(8) % with Apgar score 5 and below	(9) Average no. of prenatal care visits	(10) % < than 5 prenatal care visits	(11) % prenatal care in first trimester
White mothers											
unemployment rate	-0.004*	0.002**	0.020***	-0.008	-0.0001	0.000001	-0.00003	0.00006*	0.282**	-0.015***	-0.001
	(0.002)	(0.001)	(0.002)	(0.008)	(0.000)	(0.00006)	(0.00004)	(0.00003)	(0.138)	(0.005)	(0.000)
% of population age >65	-0.575	1.905***	-6.064***	-28.616***	0.049	-0.10658***	-0.02342*	0.02612	220.987***	-13.420***	0.546***
	(1.099)	(0.617)	(1.149)	(6.161)	(0.117)	(0.02526)	(0.01199)	(0.01922)	(84.586)	(3.428)	(0.182)
% of population age 5-17	0.000	-0.001***	0.000	0.006***	0.000	0.00002*	0.00002***	0.00000	-0.058**	0.004***	0.000
	(0.001)	(0.000)	(0.000)	(0.002)	(0.000)	(0.00001)	(0.00001)	(0.00001)	(0.026)	(0.001)	(0.000)
Average WIC benefits	0.262	-0.032	-0.310	-5.556**	-0.105***	-0.00505	0.00163	0.00241	21.445**	-0.288	0.024
	(0.189)	(0.055)	(0.254)	(2.791)	(0.034)	(0.00409)	(0.00309)	(0.00292)	(8.622)	(0.297)	(0.033)
% on Medicaid	0.098	-0.111**	0.229	-0.685	0.048**	-0.01066**	-0.00749***	-0.00711***	-17.808**	0.537**	0.190***
	(0.135)	(0.048)	(0.175)	(0.614)	(0.023)	(0.00512)	(0.00213)	(0.00223)	(7.435)	(0.250)	(0.027)
Abortion Rate	-0.008***	0.002***	-0.006***	0.004	-0.000	-0.00001	-0.00005***	0.00002	-0.124**	-0.004	-0.002***
	(0.002)	(0.001)	(0.001)	(0.005)	(0.000)	(0.00003)	(0.00002)	(0.00002)	(0.063)	(0.003)	(0.000)
Real govt pymts to individuals per cap, $1982	-0.151***	0.064***	-0.124***	-0.419**	-0.009	0.00266**	0.00139**	-0.00067	0.219	-0.191***	-0.021***
	(0.054)	(0.017)	(0.046)	(0.178)	(0.006)	(0.00130)	(0.00058)	(0.00080)	(1.438)	(0.067)	(0.008)
Black mothers											
unemployment rate	0.015***	-0.002***	0.038***	0.016***	-0.001**	-0.00049***	-0.00011*	-0.00007	0.257***	-0.010***	0.003***
	(0.002)	(0.001)	(0.003)	(0.005)	(0.000)	(0.00015)	(0.00007)	(0.00023)	(0.096)	(0.003)	(0.001)
% of population age >65	-1.246	0.141	1.759	-7.126**	0.145	-0.03758	0.04610	-0.23202	128.118*	-10.213***	1.175***
	(1.012)	(0.357)	(1.810)	(3.599)	(0.181)	(0.08616)	(0.03521)	(0.30226)	(66.372)	(2.478)	(0.371)
% of population age 5-17	-0.002***	-0.000*	0.001	0.001	-0.000	0.00006	0.00006***	0.00001	-0.023	0.004***	-0.001***
	(0.001)	(0.000)	(0.001)	(0.002)	(0.000)	(0.00005)	(0.00002)	(0.00006)	(0.024)	(0.001)	(0.000)
Average WIC benefits	0.207	-0.034	-0.329	-1.086	-0.096***	0.02024	0.00762	0.00803	17.826**	0.089	0.057
	(0.134)	(0.032)	(0.367)	(1.706)	(0.033)	(0.01464)	(0.00684)	(0.01104)	(7.565)	(0.140)	(0.053)
% on Medicaid	0.297*	-0.021	-0.796***	0.168	0.021	-0.04381***	-0.01300**	-0.02578***	-28.177***	0.544***	0.101*
	(0.154)	(0.038)	(0.297)	(0.502)	(0.033)	(0.01411)	(0.00616)	(0.00986)	(7.640)	(0.203)	(0.055)
Abortion Rate	-0.002	-0.000	0.003*	-0.001	-0.000	0.00023***	0.00004	-0.00022	-0.012	-0.004**	0.000
	(0.002)	(0.000)	(0.002)	(0.004)	(0.000)	(0.00008)	(0.00004)	(0.00024)	(0.052)	(0.002)	(0.000)
Real govt pymts to individuals per cap, $1982	-0.208***	0.061***	-0.233***	-0.562***	-0.055***	0.01621***	0.00524***	0.01168	-0.776	-0.043	-0.060***
	(0.039)	(0.010)	(0.087)	(0.131)	(0.010)	(0.00391)	(0.00166)	(0.01227)	(1.415)	(0.049)	(0.015)

Notes: Data from the Natality Files are aggregated to the state, year, and race level, for states and years as listed in Appendix A. The unemployment rate is calculated at the state-year level and matched to the Natality Files by the year of conception of the baby. Data for average WIC benefits, population on Medicaid, the abortion rate, and real government transfers per capita are interpolated for missing years. Data on additional controls: population (available for all years), average WIC benefits (available for all years), percentage on Medicaid (available 1980 onward, extrapolated to 1976) abortion rate (available 1978-1982, 1984, 1985, 1987, 1988, 1991, 1992, 1996, interpolated to other years), and real government transfers (available all years). Robust standard errors are in parentheses. Regressions include state and year fixed effects and state-specific trends. They are weighted by the number of births in the state. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Figure 1



Unemployment rate by state, 1975-1999

Table 1: Summary Statistics for Aggregate Natality Data

Sample	All		White		Black	
			Mean	Std. Dev.	Mean	Std. Dev.
Unemployment rate (state and year)			6.58	1.97	6.69	1.96
Infant mortality			826	190	1850	955
Neonatal mortality			533	146	1150	681
Post-neonatal mortality			293	81	699	622
Abortion rate per 1000 women (Guttmacher)	22.62	12.14				
Abortion per live birth (CDC)			0.42	1.37	1.73	11.28
Birth rate			0.014	0.0033	0.019	0.005
Percent of black babies	0.144	0.153				
Year of conception			1987.64	6.39	1987.71	6.34
White mom=1	0.84	0.36				
Female infant=1			0.49	0.50	0.49	0.50
Young=1 if mom less than 30 years old			0.75	0.43	0.82	0.38
First child=1			0.34	0.47	0.26	0.44
Mother's age			26.84	4.24	25.25	4.30
Mother's education			12.75	0.86	12.31	0.55
% moms less than high school			0.18	0.10	0.23	0.09
Father's education			13.21	0.50	12.84	0.57
% moms married			0.86	0.07	0.48	0.18
% born below 2500 grams			0.06	0.01	0.13	0.02
% born below 1500 grams			0.01	0.002	0.03	0.01
5 minute Apgar score			9.00	0.17	8.88	0.26
% with Apgar score 5 and below			0.01	0.01	0.02	0.03
Number of prenatal care visits			11.19	3.33	9.92	3.07
% with fewer than 5 prenatal			0.10	0.20	0.17	0.15
% had prenatal care in first trimester			0.82	0.06	0.66	0.09
Unemployment rate (state and year)			6.58	1.97	6.69	1.96
% covered by Medicaid (state and year)			5.81	2.06	11.84	4.79
Smoked any time during pregnancy*			0.148	0.066	0.115	0.070
Drank any time during pregnancy*			0.013	0.015	0.019	0.017

Notes: Data aggregated by state, year of conception, gender of baby, young status of mother and whether infant is first baby. Number of observations in cell used as weights.
*These variables are only calculated from 1989-1999 since the information only started being collected by states in 1989

Table 2: Effect of Unemployment on Birthrate and Percent Black

Dependent variable	(1) White birthrate	(2) Black birthrate	(3) White birthrate	(4) Black birthrate	(5) % black babies	(6) % black babies
unemployment rate	-0.0006***	-0.0011***	-0.0002	-0.0005	-0.0006**	-0.0009***
	(0.0002)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
% sd effect of one sd u-rate Δ	*-9.2%*	*-12.2%*	*-3.1%*	*-5.5%*	*-0.8%*	*-1.2%*
State fixed effects	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x
State-specific trend			x	x		x
Weights			x	x		x
Observations	1253	1253	1253	1253	1253	1253
R-squared	0.58	0.55	0.77	0.79	1.00	1.00

Notes: Birth rate data are by state, year, and race. White (black) birthrate=number of births divided by white (black) population by state and year. Percent black babies is the ratio of black births to total births by state and year. Births are matched to unemployment rates by state and year of conception. Robust standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Effect of Unemployment on Abortion, 1979-1998

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sample	All	White	Black	All	White	Black	White	Black	White	Black
Dependent variable	Abortion rate per live birth	Abortion rate per live birth	Abortion rate per live birth	Abortion per fertile woman	Abortion per fertile woman	Abor-tion per fertile woman	Abor-tion per fertile woman	Abor-tion per fertile woman	Abor-tion rate per live birth	Abor-tion rate per live birth
Data source	Guttmacher	CDC	CDC	Guttmacher	CDC	CDC	CDC	CDC	CDC	
Unemployment rate	0.040	0.031	0.078**	-0.413***	0.0002	0.004**	-0.0002	0.026	0.045	0.255*
	(0.036)	(0.025)	(0.032)	(0.112)	(0.0003)	(0.002)	(0.0006)	(0.018)	(0.031)	(0.153)
% sd effect of one sd u-rate Δ	*7.9%*	*5.3%*	*6%*	*-6.8%*	*2.1%*	*1%*	--	--	--	--
More than high school							0.0391	0.892	-2.851	10.253
							(0.0358)	(0.651)	(3.345)	(6.722)
Unemployment rate x more than high school							0.0022	-0.112	-0.080	-0.922
							(0.0024)	(0.086)	(0.123)	(0.692)
Observations	612	173	173	612	173	173	170	170	170	170
R-squared	0.42	0.98	0.98	0.97	0.99	0.97	0.99	0.96	0.98	0.97

Notes: Unemployment is at the state-year level and matched to state-year abortion data. Abortion data from the Alan Guttmacher Institute are by state and year for 1978-82, 1984-88, 1991, 1992, and 1996. Data from the Centers for Disease Control are Robust standard errors are by state, year, and race for 1975-77, 1980-81, and 1989-99. Robust standard errors are in parentheses. Regressions include state and year fixed effects, and state-specific trends. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 4a: Effect of Unemployment on Children's health outcomes

Dependent variable	(1) % born below 2500 grams	(2) % born below 1500 grams	(3) % with Apgar score 5 and below	(4) Infant mortality rate	(5) Neo-natal mortality rate	(6) Post neonatal mortality rate
All mothers						
unemployment rate	-0.00016**	-0.00007*	-0.00001	-5.744**	-1.815	-3.932***
	(0.00006)	(0.00003)	(0.00004)	(2.684)	(2.038)	(1.190)
% sd effect of one sd u-rate Δ	*-1.92%*	*-3.07%*	*-0.62%*	*1.3%*	*0.6%*	*1.6%*
White mothers						
unemployment rate	-0.00005	-0.00005	0.00004	-3.287**	-0.639	-2.652***
	(0.00006)	(0.00003)	(0.00003)	(1.660)	(1.259)	(0.947)
% sd effect of one sd u-rate Δ	*-1.06%*	*-4.01%*	*2.95%*	*-3.46%*	*-0.88%*	*-6.55%*
Black mothers						
unemployment rate	-0.00078***	-0.00020***	-0.00016	-15.300**	-6.330	-8.968***
	(0.00016)	(0.00006)	(0.00029)	(6.113)	(5.145)	(2.955)
% sd effect of one sd u-rate Δ	*-3.58%*	*-2.06%*	*-2.11%*	*-3.20%*	*-1.86%*	*-2.88%*

Notes: Data from the Natality Files are aggregated to the state, year, and race level, for states and years as listed in Appendix A. The unemployment rate is calculated at the state-year level and matched to the Natality Files by the year of conception of the baby and to mortality data by the year of child mortality. Child mortality data are by state and year for 1979-1998. Infant morality rates are computed as the number of infant that die within a year of birth as a fraction of live births *1000, and likewise for neo-natal mortality (the number of infant that die within 28 days) and post-neonatal mortality (number of infant that die between 28 days and a year of birth). All regressions include state and year fixed effects and state-specific trends. They are weighted by the number of births in the state. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 4b: Effect of Unemployment on Mother Characteristics and behaviors by Race, 1976-1998

Dependent variable	(1) Average mother's education	(2) % moms less high school	(3) Average mother's age	(4) Average father's education	(5) % married	(6) Average no. of prenatal care visits	(7) % < than 5 prenatal care visits	(8) % prenatal care in first trimester	(9) Smoked during pregnancy	(10) Drank during pregnancy
White mothers										
unemployment rate	-0.001	0.001	0.022***	0.012***	0.0001	0.31507***	-0.01421***	0.00050	0.00345**	0.00135
	(0.003)	(0.001)	(0.002)	(0.002)	(0.0003)	(0.07728)	(0.00295)	(0.00110)	(0.00147)	(0.00139)
% sd effect of one sd u-rate Δ	*-0.42%*	*3.47%*	*3.62%*	*4.92%*	*0.30%*	*27.2%*	*-29.1%*	*1.9%*	16.4%	*16.4%*
Black mothers										
unemployment rate	0.018***	-0.003***	0.041***	0.027***	-0.0052	0.25844***	-0.01017***	0.00427***	-0.00018	-0.00136***
	(0.002)	(0.001)	(0.003)	(0.003)	(0.0004)	(0.05615)	(0.00188)	(0.00125)	(0.00100)	(0.00042)
% sd effect of one sd in u-rate	*8.09%*	*-6.88%*	*8.70%*	*9.65%*	*-5.74%*	*20.8%*	*-19.2%*	*9.7%*	*-0.5%*	*-12.6%*

Notes: Data from the Natality Files are aggregated to the state, year, and race level, for states and years as listed in Appendix A. The unemployment rate is calculated at the state-year level and matched to the Natality Files by the year of conception of the baby. Regressions include state and year fixed effects and state-specific trends. They are weighted by the number of births in the state. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Effect of Unemployment by Race, 1976-1996
Specification checks

Dependent variable	(1) Average mother's education	(2) % moms less high school	(3) Average mother's age	(4) Average father's education	(5) % married	(6) % born below 2500 grams	(7) % born below 1500 grams	(8) % with Apgar score 5 and below	(9) Average no. of prenatal care visits	(10) % < than 5 prenatal care visits	(11) % prenatal care in first trimester
Panel A: Instrument: Lagged unemployment rate											
White mothers											
unemployment	0.001	0.000	0.032***	0.013***	0.0001	-0.00014*	-0.00017***	0.00002	0.295**	-0.009	0.002***
rate	(0.004)	(0.001)	(0.003)	(0.003)	(0.0004)	(0.00007)	(0.00004)	(0.00004)	(0.142)	(0.006)	(0.001)
Black mothers											
unemployment	0.022***	-0.002***	0.046***	0.027***	-0.002***	-0.00109***	-0.00037***	-0.00026	0.242**	-0.008**	0.006***
rate	(0.003)	(0.001)	(0.004)	(0.004)	(0.001)	(0.00019)	(0.00008)	(0.00034)	(0.097)	(0.004)	(0.001)
Panel B: Effect of Employment to population ratio											
White mothers											
emp. pop. ratio	0.164	-0.115	-1.48***	-1.067***	0.038	0.00976*	0.00773***	-0.00763	-30.899**	0.780	-0.142***
	(0.217)	(0.090)	(0.202)	(0.190)	(0.027)	(0.00533)	(0.00268)	(0.00536)	(14.320)	(0.588)	(0.038)
Black mothers											
emp. pop. ratio	-1.27***	0.174***	-2.16***	-1.953***	0.132***	0.08068***	0.02487***	0.01523	-29.701***	0.462	-0.368***
	(0.221)	(0.060)	(0.327)	(0.343)	(0.036)	(0.01561)	(0.00604)	(0.01071)	(10.971)	(0.410)	(0.064)

Notes: Data from the Natality Files are aggregated to the state, year, and race level, for states and years as listed in Appendix A. The unemployment rate is calculated at the state-year level and matched to the Natality Files by the year of conception of the baby. The employment-to-population ratio is at the state-year level for 1976-1998. Robust standard errors are in parentheses. Regressions include state and year fixed effects and state-specific trends. They are weighted by the number of births in the state. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Effect of Unemployment by Race and Marital Status, 1976-1998

Dependent variable	(1) Average mother's education	(2) % moms less high school	(3) Average mother's age	(4) Average father's education	(5) % born below 2500 grams	(6) % born below 1500 grams	(7) % with Apgar score 5 and below	(8) Average no. of prenatal care visits	(9) % < than 5 prenatal care visits	(10) % prenatal care in first trimester
White married mothers										
unemployment rate	-0.006***	0.001***	0.014***	0.00002	-0.00002	0.005***	0.00012***	0.024***	0.0004**	0.001***
	(0.002)	(0.0003)	(0.003)	(0.00007)	(0.00003)	(0.002)	(0.00004)	(0.004)	(0.0002)	(0.0004)
White single mothers										
unemployment rate	-0.008*	0.002***	0.036***	0.00004	0.00010	-0.002	0.00010	0.024***	-0.001	0.001**
	(0.004)	(0.001)	(0.005)	(0.00016)	(0.00006)	(0.003)	(0.00009)	(0.005)	(0.0003)	(0.001)
Black married mothers										
unemployment rate	0.006**	-0.000	0.045***	-0.00015	-0.00004	0.004	0.00021	0.025***	0.001*	0.003***
	(0.003)	(0.000)	(0.005)	(0.00018)	(0.00010)	(0.005)	(0.00022)	(0.009)	(0.0004)	(0.001)
Black single mothers										
unemployment rate	0.023***	-0.002***	0.003	-0.00053**	-0.0005***	-0.005	-0.00020	0.068***	-0.002**	0.007***
	(0.004)	(0.0005)	(0.005)	(0.00021)	(0.0002)	(0.006)	(0.00042)	(0.012)	(0.001)	(0.001)

Notes: Data from the Natality Files are aggregated to the state, year, race, and marital status level, for states and years as listed in Appendix A. The unemployment rate is calculated at the state-year level and matched to the Natality Files by the year of conception of the baby. Robust standard errors are in parentheses. Regressions include state and year fixed effects and state-specific trends. They are weighted by the number of births in the state. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Proportion of Births by Education Categories and Race

Education category	(1) High school dropout	(2) High school	(3) Some college	(4) College plus
<u>Whites</u>				
Unemployment rate	0.0006*** (0.0002)	0.0003** (0.0001)	-0.0005*** (0.0001)	-0.0004*** (0.0002)
<u>Blacks</u>				
Unemployment rate	-0.0002 (0.0003)	-0.00005 (0.00065)	0.00005 (0.00054)	-0.000001 (0.00036)

Table 8: Effect of Transfers on the Quality Effect, 1976-1998

Dependent variable	(1) Average mother's education	(2) % moms less high school	(3) Average mother's age	(4) Average father's education	(5) % married	(6) % born below 2500 grams	(7) % born below 1500 grams	(8) % with Apgar score 5 and below	(9) Average no. of prenatal care visits	(10) % < than 5 prenatal care visits	(11) % prenatal care in first trimester
White moms											
unemployment rate	-0.009***	0.002	0.018***	0.013***	-0.001*	0.00008	0.00003	0.00002	0.465**	-0.016*	0.00003
	(0.003)	(0.002)	(0.003)	(0.003)	(0.0005)	(0.00007)	(0.00003)	(0.00003)	(0.190)	(0.008)	(0.001)
High transfer state*urate	0.012***	-0.002	0.008***	-0.002	0.002***	-0.00024***	-0.00014***	0.00004	-0.299**	0.005	0.001
	(0.004)	(0.001)	(0.003)	(0.003)	(0.001)	(0.00007)	(0.00004)	(0.00004)	(0.129)	(0.006)	(0.001)
Black moms											
unemployment rate	0.019***	-0.003***	0.037***	0.028***	-0.0002	-0.00082***	-0.00023***	0.00006	0.377***	-0.010**	0.005***
	(0.003)	(0.001)	(0.004)	(0.004)	(0.0004)	(0.00018)	(0.00007)	(0.00013)	(0.123)	(0.005)	(0.001)
High transfer state*urate	-0.002	0.0004	0.007*	-0.002	-0.001	0.00008	0.00008	-0.00041	-0.242**	0.000	-0.002**
	(0.002)	(0.001)	(0.004)	(0.004)	(0.001)	(0.00020)	(0.00008)	(0.00048)	(0.095)	(0.003)	(0.001)

Notes: Data from the Natality Files are aggregated to the state, year, and race level, for states and years as listed in Appendix A. The unemployment rate is calculated at the state-year level and matched to the Natality Files by the year of conception of the baby. High transfer states are identified by regressing per capita state transfers on state and year fixed effects, where states with an above-median state dummy in this regression are identified as high-transfer states. Robust standard errors are in parentheses. Regressions include state and year fixed effects and state-specific trends. They are weighted by the number of births in the state. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 9a: Effect of Unemployment on Birth Weight and Prenatal Care, California, 1990-2000

Dependent variable	(1) born below 2500 grams	(2) born below 1500 grams	(3) Average no. of prenatal care visits	(4) < than 5 prenatal care visits	(5) prenatal care in first trimester
White mothers					
unemployment rate	0.00041	0.00004	0.0348***	-0.00005	0.0025***
	(0.00037)	(0.00016)	(0.0066)	(0.00027)	(0.00060)
% sd effect of one sd u-rate					
Δ	*0.34%*	*0.07%*	*1.69%*	*-0.06%*	*1.44%*
Add county specific trend					
unemployment rate	-0.00095**	0.00018	0.025***	-0.00063 *	0.002***
	(4.7e-04)	(1.9e-04)	(0.008)	(3.6e-04)	(7.6e-04)
Black mothers					
unemployment rate	-0.0020	-0.00076	0.0369*	-0.00045	0.00069
	(0.0014)	(0.00071)	(0.0202)	(0.0011)	(0.0019)
% sd effect of one sd in u-rate	*-1.65%*	*-1.42%*	*1.79%*	*-0.54%*	*0.40%*
Add county specific trend					
unemployment rate	-0.00095	-0.000084	-0.004	-0.002**	0.001
	(0.002)	(9.0e-04)	(0.026)	(0.001)	(0.002)

Notes: Robust standard errors are in parentheses. Individual level data from the California Birth Certificate Files from 1990 to 2000. The unemployment rate is calculated at the county-year level and matched by year of conception of the baby. Regressions include county and year fixed effects, and state-specific trends where specified.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 9b: Effect of Unemployment on Birth Weight and Prenatal Care, California, 1990-2000, Multiple Births sample

Dependent variable	(1) born below 2500 grams	(2) born below 1500 grams	(3) Average no. of prenatal care visits	(4) < than 5 prenatal care visits	(5) prenatal care in first trimester
NO FIXED EFFECTS					
White mothers					
unemployment rate	0.0011*	-5.33e-07	0.0286***	0.00022	0.0013
	(0.00058)	(0.00024)	(0.0096)	(0.00039)	(0.00084)
% sd effect of one sd u-rate Δ	*0.91%*	*0.00%*	*1.39%*	*0.26%*	*0.75%*
Add county specific trend					
unemployment rate	0.002***	1.6e-04	0.034***	-7.7e-04	0.001
	(7.2e-04)	(2.9e-04)	(0.012)	(5.1e-04)	(0.001)
Black mothers					
unemployment rate	-0.0034	-0.0015	0.0532*	-0.0016	0.0036
	(0.0022)	(0.0011)	(0.0296)	(0.0017)	(0.0028)
% sd effect of one sd in u-rate	*-2.80%*	*-2.81%*	*2.59%*	*-1.92%*	*2.07%*
Add county specific trend					
unemployment rate	-0.004	-0.002**	0.033	-0.005***	0.006
	(0.003)	(0.001)	(0.038)	(0.002)	(0.004)
MOTHER FIXED EFFECTS					
White mothers[(a)]					
unemployment rate	0.00054	-0.00033	0.0328***	-0.00016	0.0016
	(0.00063)	(0.00027)	(0.0114)	(0.00051)	(0.0010)
% sd effect of one sd u-rate Δ	*0.45%*	*-0.61%*	*1.59%*	*-0.19%*	*0.90%*
Add county specific trend					
unemployment rate	0.001	-1.9e-04	0.022	-0.002***	0.002**
	(8.3e-04)	(3.5e-04)	(0.015)	(6.7e-04)	(0.001)
Black mothers					
unemployment rate	-0.00022	0.00047	0.0112	-5.64e-06	0.0024
	(0.0025)	(0.0013)	(0.0355)	(0.0022)	(0.0035)
% sd effect of one sd in u-rate	*-0.18%*	*0.87%*	*0.54%*	*-0.01%*	*1.39%*
Add county specific trend					
unemployment rate	4.5e-04	8.1e-04	-0.009	-0.003	0.003
	(0.003)	(0.002)	(0.043)	(0.003)	(0.004)

Notes: Robust standard errors are in parentheses. Individual level data from the California Birth Certificate Files from 1990 to 2000. The unemployment rate is calculated at the county-year level and matched by year of conception of the baby. Regressions include county and year fixed effects, and state-specific trends where specified.

(a) These results with both mother fixed effects and county specific trends are based on a 80% random sample of mothers with multiple births because of computational constraints. This is true only for the sample of white moms.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 10: The effect of unemployment on infant health outcomes: Country level panel 1980-1999

Dependent variable	(1) Birth rate (per 1,000 people)	(2) Birth rate (per 1,000 people)	(3) Infant mortality rate (per 1,000 live births)	(4) Infant mortality rate (per 1,000 live births)	(5) Infant mortality rate (per 1,000 live births)	(6) Infant mortality rate (per 1,000 live births)	(7) Death rate (per 1,000 people)	(8) Death rate (per 1,000 people)
Unemployment, total (% of total labor force)	-0.059***		-0.152***		-0.089**		0.005	
	(0.018)		(0.045)		(0.041)		(0.007)	
Mean 8.41, s.d. 5.78								
Lagged unemployment		-0.070***		-0.157***		-0.094***		-0.008
		(0.019)		(0.041)		(0.039)		(0.007)
Birth rate, crude (per 1,000 people)					1.071***	0.889***		
					(0.076)	(0.070)		
Mean	17.678		19.152				8.5013	
(s.d.)	(7.907)		(9.785)				(0.573)	
Observations	1037	919	1037	919	1037	919	1037	919
R squared	0.97	0.97	0.97	0.98	0.98	0.98	0.96	0.97

Notes: Variables are computed at the country-year level for an unbalanced panel of 118 countries. Robust standard errors are in parentheses. Regressions include country and year fixed effects. Data: World Development Indicators (WDI) collected by the World Bank, available online at: http://www.worldbank.org.