THE TIMING OF BIRTHS: IS THE QUALITY OF INFANTS COUNTER-CYCLICAL?*

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Abstract:

This paper examines whether there is a counter-cyclical pattern in the quality of children. In particular, we study the relationship between the unemployment rate and several measures of parental characteristics, parental behavior behavior, and child health. Using data from the Natality files, including panel level data of mothers, we find evidence of positive, counter-cyclical variation in babies health: when unemployment is high at the time of conception, babies are healthier at birth. Part of these improvements is due to improvements in maternal behaviors in recessions, such as greater use of prenatal care. However there is also a large part that is due to selection in the timing of births. In particular, we find evidence that low educated black mothers do not have children during recessions due to credit constraints, where as the opposite is true of white mothers, who tend to become pregnant when unemployment is high, due to lower opportunity cost. Overall we find that babies are healthier, and that this effect is greater for blacks than for whites, which is consistent with improved behavior of all, but opposite selection between black and whites.

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1. Introduction

This paper examines whether there is a counter-cyclical pattern in the quality of children. We use the term "child quality" to refer to parental characteristics and behaviors (such as mothers' age, mother's education, marital status, fathers' education, mothers' use of prenatal care, and drinking and smoking during pregnancy), and children's health (measured by infant mortality, children's birth weight and Apgar score[1]). We study the relationship between these variables and the unemployment rate. Using national data from the Natality files from 1975 onwards, we find that all babies conceived in times of high unemployment tend to have a lower incidence of low and very low birth weight and a reduced rate of infant, neo-natal, and post-neonatal morality. This positive health effects are larger for blacks than for whites. These effects are consistent with our findings (from a panel of mothers in California) that all mothers tend to increase their use of prenatal care when unemployment is high, and decrease risky behavior such as drinking and smoking. The health improvements we observe are higher for blacks than for whites because of selection: lower educated single black moms are less likely to have babies during recessions raising the average health of black babies, consistent with evidence that blacks are more likely to be credit constrained. White mothers with low levels of education on the other hand appear to be less likely to be credit constrained and more

[1] 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 inter alia Almond, Chay, and Lee (2002).

sensitive to substitution effects: they are more likely than their educated counterparts to conceive children during recessions. Average mother quality appears to fall among whites during recessions whereas in rises among black mothers.

Becker (1960) provides the theoretical framework in which to examine fertility decisions. There is an extensive literature in demographics and economics that has documented a pro-cyclical pattern in fertility, i.e. number of children (Yule 1906, Galbraith and Thomas 1941, Thomas 1941, Silver 1965, and Ben-Porath 1973, to name but a few). But there are no papers that we know of that look at the consequences of this cyclicality on child quality. But if different groups within the population (e.g., black versus white, single versus married) are differentially affected by the business cycle (a fact that has been documented inter alia by Ben-Porath 1973 for Israel and Hoynes 1999 for the U.S.), then we would expect to see different fertility responses among these groups. To the extent that these subgroups vary in terms of the health quality of their children, we would expect to see selection-induced variation in the quality of children.

Recent work by Ruhm (2000, 2003) also suggests that the business cycle can affect the health-related behavior of mothers. We study this as well, by examining the use of prenatal care. At the same time, related work in health economics has documented a counter-cyclical pattern in infant mortality (see inter alia Ruhm 2000) and more generally in mortality (Deaton and Paxson, 2001). The two facts taken together suggest one of the hypothesis that we explore in this paper, namely that the decision of some women to opt out of fertility when unemployment is high could induce a cycle in the quality of babies. If those women who choose not to conceive babies when unemployment is high (i.e., women more likely to be affected by economic uncertainty such as unmarried, black, or

low-wealth women) would also have produced less healthy babies, then we would expect to see a counter-cyclical pattern in quality. This suggests that some of the previously documented declines in infant mortality during recessions, and also the improvements in health that we document, maybe be due to selection. Of course, the behavioral effects of unemployment also account for part of these results, and we attempt to parse the 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 recently cyclical patterns in adult health and health-related behavior (Deaton and Paxson 2000; Ruhm 2000, 2003), the question of whether there is cyclical variation in the quality of birth cohorts has not been studied. Second, our results provide corroborative evidence on the extent of credit constraints in the US economy; if individuals were not credit constrained, we would not expect to find the significant effects of current unemployment that we in fact observe for blacks, i.e, lower birthrates and higher mom quality. Indirectly our results provide evidence that blacks are credit constrained and that their fertility decisions are sub-optimal. Third, 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 stage, and ask whether the rate of unemployment prior to a child's birth has an impact on subsequent outcomes, either through selection or behavioral effects. Fourth, we provide a test of the Becker (1960) theory of fertility. We corroborate indirectly that there are important income and

substitution effects that affect fertility. As such, our work is complementary to Gruber, Levine, and Staiger (1997), 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 our understanding of the effects of business cycles and points to important variations in children's health and mothers' use of prenatal care that could have policy implications for example in the treatment of pregnant women at work.

The paper is organized as follows. In Section 2 we provide a theoretical framework in order 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.

2.1 Income Effects

In the Becker theory, fertility decisions should be 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 child bearing, and could have the same effect even in the absence of credit constraints for individuals for whom the 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.

An issue 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. 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. This is not to suggest that whites and married women are not credit constrained. For the average age of mothers in the Natality files (i.e., 26) Jappelli's results suggest a 25 percent probability of being credit constrained.

(A) Selection effects

Individuals who are not credit constrained are also likely to have greater resources to devote to their own and their children's health. Accordingly, we anticipate that lower

quality mothers will choose not to have babies during times of high unemployment, with higher quality mothers continuing to have babies.

(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 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) suggests that on average, it appears that individuals are more likely to cut down on unhealthy behaviors during recessions, generating a counter-cyclical pattern in health (higher health in times of higher unemployment).

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 strongest, relative to income effects, for married women, since income from a spouse diminishes income effects for married women compared to unmarried women.[2]

(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 along this margin. But the opposite could also be true, i.e. 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 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. The latter is an outcome that we will examine in our results below.

To summarize. In response to an increase to the unemployment rate, we expect mothers that are credit constrained to delay fertility, thereby increasing the average quality of mothers and babies, mothers whose wages fall to have babies (uncertain effect on

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

quality); 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 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 1-the magnitude of the correlation between mother characteristics and children's health 2-the magnitude of the effect of maternal behavior on children's health 3-the magnitude of women's responses (elaticities).

3. Data Description and Econometric Specification

3.1 Unemployment: Data and Interpretation

Our primary measure of unemployment will be the state-by-year unemployment rate published by the Bureau of Labor Statistics. We graph the unemployment rate by state and year in Figure 1. This figure shows that there is considerable variation across states and within states overtime in unemployment rates. It is this variation that we exploit.

What does the unemployment rate capture? 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.

A concern regarding the unemployment rate is measurement error. 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, which contains records from birth certificates covering every single birth in the US. These data contain information on parents' characteristics such as age, marital status, and education, mother's behavior during pregnancy (prenatal care information, and information about smoking and drinking) and child health outcomes including birth weight and the 5-minute Apgar scores. 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 the births. It was not until 1985 that all states reported 100% of births (see Appendix A for more details). For this reason we weight our regression using number of births in each state. Most importantly, we use the date of 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 most years (and is missing 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. Smoking and drinking were not reported until 1989 and several states did not report these items after 1989. Appendix A documents variable availability for each state and year. Our regressions do 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, which contain enough information to identify mothers who have more than one birth in California during the 1990-2000 period. 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 at all and is therefore not available in the California panel, such as drinking or smoking (again see Appendix A for details).We are very grateful to Roland Fryer and Steven Levitt for providing access to this data.

3.4 Other data

We use infant mortality data provided by the Center for Disease Control. Abortion data come from both the 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 gracefully made available by Anne Case. WIC benefits were obtained from the US Department of Agriculture.

Finally we use panel country level data from the World Bank indicators that is available online. It contains information on infant mortality rates, birth rates and 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), 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 some other coincident shock. Our use of state and year fixed effects,

and of state-specific trends addresses these concerns to some extent. We also add a range of additional 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, i.e., 2 percent, increase in unemployment leads to a 12.2 percent of a standard deviation reduction in the birthrate for blacks, compared to 9.2 percent for whites). The inclusion of state-specific trends, 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 Alan Guttmacher Institute and the Centers for Disease Control (the former is regarded as more accurate, but is not broken down by race). In columns (1) to (3), for the full population and whites and blacks separately, we find abortions per live birth increase with unemployment, though 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 still find a positive effect for the CDC data, significant for blacks at the one percent level. (This is 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.

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 presents our main results. For mother characteristics, childbirth outcomes, prenatal care, and smoking and drink 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 (though 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 and post-neonatal 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 significant different racial differences in health. In the 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 mother characteristics and mother behaviors during pregnancy. Note that changes behavior indicators 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, though 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.

In the other hand, 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, all 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 increase.

Consequently, for blacks, evidence of improved birth weight and other behaviors measured in Table 4a is consistent with both a selection effect and substitution into health-improving behavior. For whites, results are different. The statistically significant effects in Table 4a point to improved quality, but the smoking effect 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.

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 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. Nonetheless, we instrument for the unemployment rate using lagged unemployment. 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. 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.[3] Additional estimations (Appendix B) also suggest that our results are fairly robust to the inclusion of additional covariates, so that omitted variables bias does not appear to be a major concern.

3 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.

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: 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 is leading 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, though weaker. Average education falls, though 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 maybe expected if these mothers are indeed more credit constrained. Indeed, our results suggest that improvements in birth weight among blacks are driven by increases among single black mothers.

5. Corroborating 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 the selection, mainly as shown by average education effect (smoking and drinking 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 birth rate among high school and high school dropout mothers, and a decrease in the proportion of birth among mothers with more than high school education. Instead, 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 moms with a high school degree or less, an increase in those born to moms with some college, and finally a (unexpected) decrease among college-plus mothers, but these decrease is a hundred times 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 greater abortion. 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 single mothers than 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, on the view that state transfers offset, to some extent, individual credit constraints. 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

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 transfer as suggesting that lower educated black women have relatively fewer babies during recessions, possibly because they are credit constrained. On the other hand the results suggest that lower educated mother have relatively more babies during recessions, possibly due to substitution effects that are stronger than the effects of credit constraints. These results provide direct evidence for the selection effects discussed in Section 4.

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 worsening 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 data. 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's 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 the change in the type of women that give birth.

In table 9a, we begin by estimating regressions that are identical to those we estimate at the state/year level, including all moms in the California data, in order to see whether results in the California data mirror the national results we have presented so far. 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 Californian 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) and finally the California data looks at 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 Californian mothers, but the magnitude of the effects is much smaller than at the national level. We conclude that 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 only to mothers that are observed at least twice in the California birth certificate data. We

do so to see if there appears to be evidence that the effects of unemployment are different for mothers with multiple births. The evidence in Panel A of table 9b suggests that the effects of the unemployment rate are similar for black moms observed once and for those observed twice, but again the magnitudes of the effects are somewhat different. Among white moms however, there is evidence of negative selection effects in the birthweight outcomes which we did not observe in the national sample: we find here 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 is improves.

In Panel B of table 9 we present results using the multiple birth sample including now mother fixed effects. The effects of unemployment are therefore 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 (i.e. once we add fixed effects) then the negative effect of unemployment on birth outcomes becomes much smaller for whites, but the prenatal care use effects 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. At the national level, it would therefore seem like the positive effect of behavior 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 once we include fixed effects in this sample, all coefficients become insignificant, we cannot rule out that among black moms in

California, all health improvements associated with increase 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 that are observed twice. So these results would suggest that at the national level improvements in health outcomes among black babies are due to selection and possibly also due to better mother behavior.

6.2 How general are our findings? Results using Cross-Country Data

Finally, we conclude our discussion by examining whether results similar to those we have found for the US 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 the blacks in the US in that we observe that when more babies are born, they tend to be less healthy on average. Finally, in columns (7) and (8) we show 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 this preliminary country level results, and improving these results, we feel, is beyond the scope of this paper. Nonetheless, we note that the results we obtain using this country level panel are consistent our findings from the US.

6. Conclusion

In this paper we have examined whether the business cycle induces a cycle in the quality of children. Based on the well-known fact that fertility is pro-cyclical and the observation that abortion tends to increase counter-cyclically, we argue that mothers exercise increased selectivity in fertility decisions in times of high unemployment. Within the Becker fertility framework, the women most likely to experience such income effects are those who are credit constrained. To the extent that credit constrained mothers opt out of fertility during downturns and would also have produced less healthy children, we anticipate that those women who choose to have babies during downturns will tend to be higher quality and produce healthier children. On the other hand, due substitution effects, mothers whose wage falls may be more likely to have babies during downturns when the opportunity cost is low. If substitution effects differ across SES groups the quality of babies will also be affected although the direction depends on which groups are more sensitive to his substitution effect.

Using the Natality files we establish that these relationships hold in the data. We find that lower educated single black moms are less likely to have babies during

recessions raising the average health of black babies. This result is consistent with evidence that blacks are more likely to be credit constrained. Low education white mothers on the other hand appear to be less likely to be credit constrained and more sensitive to substitution effects: they are more likely than their educated counterparts to conceive children during recessions. Average mother quality appears to fall among whites during recessions.

On the other hand, recessions also have effects on consumer behavior, temporary changes in income and wages affect mothers consumption of goods. We find that all mothers tend to increase their use of prenatal care when unemployment is high, and we also find evidence of decreases in risky behavior such as drinking and smoking.

Overall, we observe that all babies tend to have a lower incidence of low and very low birth weight and a reduced rate of infant, neo-natal, and post-neonatal morality. This positive health effects are larger for blacks than for whites, which is consistent with our findings that even though all moms are behaving better, black moms are also of higher quality. These results are robust to a wide range of specifications and controls. Furthermore, we establish that these relationships also seem to hold for cross-country data.

Our results are interesting for several reasons. First, our main finding – a counter-cyclical pattern in the health of babies – is new stylized fact for the fertility and health literatures. Second, our results show that some of the previously documented improvements in child health are due to improvements in the quality of mothers (i.e., selection) and not only to improvements in behavior. Nonetheless we also find important behavioral changes. 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 phenomenon (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 US economy, especially for minorities. Furthermore these credit constraints results in sub-optimal fertility decisions since women's fertility choices would differ in the absence of these constraints. Secondly 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 making these behavioral changes. If, as many have suggested, increasing birth outcomes should be a policy target, then policies that for example look to minimize the effect of taking time off work to attend prenatal care.

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. A somewhat puzzling finding in our results is the strikingly different response to unemployment between educated blacks and whites. It would be interesting to discover the underlying cause of this difference. Another very important extension would look at whether the effects of unemployment on the selection and behavior of mothers has important long term effects. These are avenues for future research.

Bibliography

Becker, Gary, "An Economic Analysis of Fertility," in *Demographic and Economic Change in Developed Countries*, National Bureau of Economic Research Series, Number 11, Princeton University Press, 1960.

Ben-Porath , Yoram, "Short term fluctuations in fertility and Economic Activity in Israel," *Demography*, Volume 10, Issue 2, May 1973.

Blank, Rebecca, Christine George, and Rebecca London, "State Abortion Rates: The Impact Of Policies, Providers, Politics, Demographics And Economic Environment," *Journal of Health Economics*, Vol.15, pp.513-553, 1996.

Douglas Almond , Kenneth Chay, and David Lee, "Does Low Birth Weight Matter? Evidence from the U.S. Population of Twin Births," University of California, Berkeley, Center for Labor Economics, Working Paper Number 53, 2002.

Deaton, Angus and Christina Paxson, "Mortality, income, and income inequality over time in Britain and the US," National Bureau Of Economic Research Working Paper Number 8523, October 2001.

Fiscella, K., "Does Prenatal Care Improve Birth Outcomes: A Critical Review," *Obstetrics and Gynecology*, Vol. 85, Number 3, pp. 468-479, 1995.

Galbraith, Virginia L. and Dorothy S. Thomas, "Birth Rates and the Interwar Business Cycles," *Journal of the American Statistical Association*, Volume 36, Issue 216, December 1941.

Gruber, Jonathan, Philip Levine and Douglas Staiger, "Abortion Legalization and child living circumstances: who is the marginal child?," *Quarterly Journal of Economics*, Volume 114, Number 1, pp. 263-291, 1999.

Hoynes, Hillary, "The Employment, Earnings, and Income of Less Skilled Workers Over the Business Cycle," National Bureau Of Economic Research Working Paper Number 7188, June 1999.

Jappelli, Tullio, "Who is Credit Constrained in the U.S. Economy?" *Quarterly Journal of Economics*, Volume 105, Number 1, pp. 219-234, 1990.

Levine, Philip, "The Impact of Social policy and economic activity throughout the fertility decision tree," National Bureau Of Economic Research Working Paper Number 9021, June 2002.

Paxson, Christina, and Jane Waldfogel, "Work, Welfare, and Child Maltreatment," *Journal of Labor Economics*, Vol. 20, pp. 435-474, 2002.

Ruhm, Christopher, "Are recessions good for your health?," *Quarterly Journal of Economics*, 115(2): 617-50, 2000.

Shea, John, "Does Parents' Money Matter?" *Journal of Public Economics*, Vol. 77, pp. 155-184, 2002.

Shimer, Robert, "The Impact of Young Workers on the Aggregate labor Market," Princeton University Mimeo, August 2000

Silver, Morris, "Births, Marriages, and the Business Cycles in the Unites States, *Journal of Political Economy*, Volume 73, Issue 3, June 1965.

Thomas, Dorothy S., *Social and Economic Aspects of Swedish Population Movements, 1750-1933*, New York, Macmillan Co., 1941.

Waldfogel, Jane, Wen-Jui Han, and Jeanne Brooks-Gun, "The Effects of Early Maternal Employment on Child Cognitive Development," *Demography*, Volume 39, pp. 369-392, 2002.

Welch, Finis, "Effects of Cohort Size on Earnings: The Baby Boom Babies' Financial Bust," *Journal of Political Economy*, Vol. 87, pp. S65-97, 1979.

Welch, Finis, "The Quality of Education and Cohort Variations in Black-White Earnings Differentials: Reply," *American Economic Review*, Vol. 70, pp. 192-195, 1980.

Yule, G. Udny, "On the Changes of Marriage and Birth Rates and England and Wales During the Past Half Century; With an Inquiry as to Their Probable Causes," *Journal of the Royal Statistical Societ*y, vol.69, 1906

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

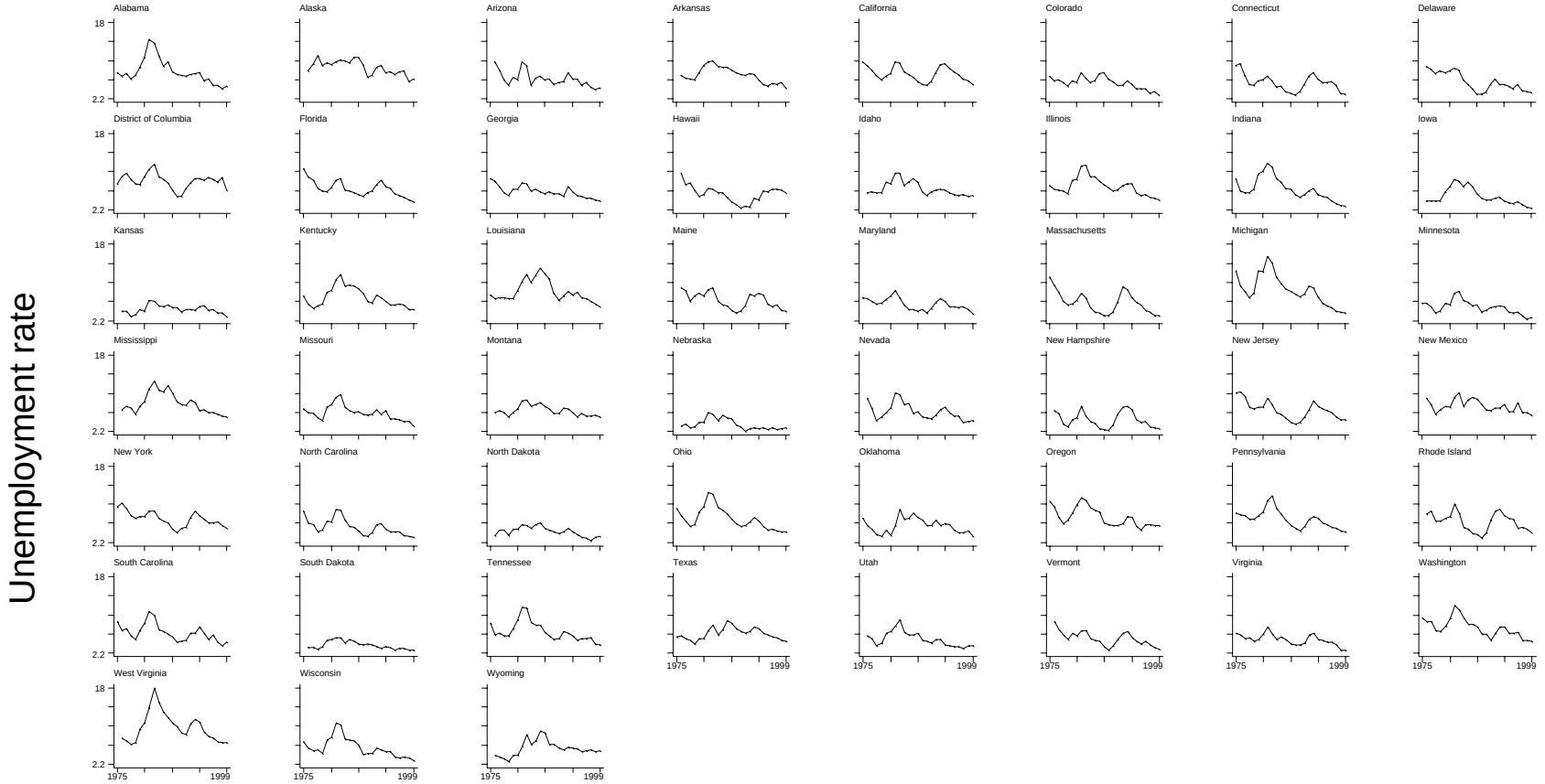
State	*Year started 100% reporting*	*Educational attainment of parents**	*Date last normal menstrual period began (LMP)*	*Prenatal care information*	*Legitimacy status--Marital status*	*5-minute Apgar score*	*Drinking while pregnant*	*Smoking while pregnant*
Montana	1974	1975-	1975-	1975-	1988-	1978-	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

Year

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
Whites				
Unemployment rate	0.0006***	0.0003**	-0.0005***	-0.0004***
	(0.0002)	(0.0001)	(0.0001)	(0.0002)
Blacks				
Unemployment rate	-0.0002	-0.00005	0.00005	-0.000001
	(0.0003)	(0.00065)	(0.00054)	(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) *Mean 8.41, s.d. 5.78*	-0.059*** (0.018)		-0.152*** (0.045)		-0.089** (0.041)		0.005 (0.007)	
Lagged unemployment		-0.070*** (0.019)		-0.157*** (0.041)		-0.094*** (0.039)		-0.008 (0.007)
Birth rate, crude (per 1,000 people)					1.071*** (0.076)	0.889*** (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.