PRELIMINARY: PLEASE DO NOT CITE OR CIRCULATE

The Role of Workplace Characteristics in Breastfeeding Practices

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Abstract

The benefits of breastfeeding are well-established, yet not all mothers breastfeed. Past research demonstrates the negative relationship between maternal employment and breastfeeding, yet little is known about what generates differences in breastfeeding practices among working women. This paper seeks to understand the role of one mechanism that may affect breastfeeding practices among working women: workplace characteristics. Specifically, the effects of hours worked at home, availability of a flexible schedule, availability of employer-sponsored child care, and working a rotating schedule on breastfeeding outcomes are estimated using data from the National Longitudinal Survey of Youth 1979. Results suggest that working an additional eight hours at home per week compared to not working at home increases the probability of breastfeeding by approximately 9 and 21 percent at birth and six months after birth, respectively. The availability of employer-sponsored child care increases the likelihood of breastfeeding six months after birth by 59 percent. Working a rotating schedule and the availability of a flexible schedule do not have significant effects on breastfeeding outcomes. To understand the potential implications of these results, this study investigates whether workplace characteristics are endogenous to breastfeeding by examining women's job choices in relation to fertility behavior. Findings suggest that workplace characteristics are not endogenous to breastfeeding.

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1. INTRODUCTION

A growing body of research indicates that both mothers and children benefit from breastfeeding. Reflecting such research, public health officials and organizations such as the United States Surgeon General, the American Academy of Pediatrics, the American Pediatrics Association, the American Public Health Association, and the World Health Organization promote the practice of breastfeeding. The Federal government identifies increasing breastfeeding rates as a national health priority in its *Healthy People 2010* Initiative. Further, the Federal and state governments spend millions of dollars each year on outreach efforts to promote breastfeeding and subsidies to reduce the cost of breastfeeding supplies.

Despite such research, advocacy, and gradually increasing breastfeeding rates over the past decade, a large fraction of mothers do not breastfeed or breastfeed for a shorter period than the recommended six months of exclusive breastfeeding. United States breastfeeding rates increased 35 percent at birth and 85 percent six months after birth between 1990 and 2001 (Ryan, 2002).[1] However, in 2001, nearly one-third of mothers did not initiate breastfeeding, and only 33 percent of all mothers breastfed for six months (Ryan, 2002). Furthermore, disparities in breastfeeding rates exist with low-income, Black, less-educated, younger, and working women less likely to breastfeed.

This paper focuses on the breastfeeding practices of working mothers. This group of mothers is important to study for two reasons. First, working mothers comprise a large portion of new mothers. Over half (50.6 percent) of mothers with infants under 12 months of age were working in 2001 (BLS, 2002). Of these working mothers, 68 percent worked full-time (35 hours or more) and 32 percent worked part-time (less than 35 hours) (BLS, 2002). Second, the difference in breastfeeding rates between working and non-working mothers is large, with a mother working full-time 11 percentage points (30 percent) less likely to breastfeed six months after birth compared to a non-working mother in 2001 (Ryan, 2002).

While previous research demonstrates the negative relationship between maternal employment and breastfeeding, little is known about what generates differences in breastfeeding practices among working women. This paper seeks to understand one potential underlying mechanism that may produce disparities in breastfeeding rates among working women:

[1] The breastfeeding rates reported in this paragraph reflect any breastfeeding and not exclusive breastfeeding.

workplace characteristics. Specifically, this study examines the effects of hours worked at home, availability of a flexible schedule, availability of employer-sponsored child care, and working a rotating schedule on breastfeeding outcomes using data from the National Longitudinal Survey of Youth 1979. These workplace characteristics are frequently mentioned by breastfeeding experts as potentially effective ways to facilitate breastfeeding and work. However, to my knowledge, the effectiveness of these or similar workplace characteristics has not been empirically tested. To understand the potential implications of these results, this study also investigates whether workplace characteristics are endogenous to breastfeeding by examining women's job choices in relation to fertility behavior.

In summary, two research questions are asked in this paper. 1) What is the effect of workplace characteristics on breastfeeding initiation and breastfeeding six months after birth? 2) Are workplace characteristics endogenous to breastfeeding?

Estimates from recursive bivariate probit models suggest that working an additional eight at hours at home per week compared to not working any hours at home increases the probability of breastfeeding by approximately 9 and 21 percent at birth and six months after birth, respectively. The availability of employer-sponsored child care increases the likelihood of breastfeeding six months after birth by 59 percent. Working a rotating schedule and the availability of a flexible schedule do not have significant effects on breastfeeding outcomes. In addition, evidence suggests that workplace characteristics are not endogenous to breastfeeding practices.

The next section reviews the health benefits of breastfeeding and the previous literature on maternal employment and breastfeeding. The third section discusses the data used in this paper and the analysis sample. The fourth section outlines the empirical strategy to estimate the effects of workplace characteristics on breastfeeding. Section 5 presents the results. The potential endogeneity of workplace characteristics is explored in Section 6 and Section 7 concludes.

2. BACKGROUND

2.1 Health Benefits of Breastfeeding

There are well-established short- and long-term health benefits of breastfeeding to

children and mothers.[2,3] For a review of the benefits of breastfeeding for infants and children see Kramer and Kakuma (2003), Leon-Cava et al. (2002), and American Academy of Pediatrics (1997). Studies in the United States (US) and abroad have found evidence that children who are breastfed have lower rates of urinary tract infections, respiratory tract infections, diarrhea, allergic diseases, otitis media, bacterial meningitis, botulism, bacteremia, and necrotizing enterocolitis. These studies indicate that the health benefits of breast milk primarily accrue in the first six months of breastfeeding (Kramer and Kakuma, 2003). Studies also suggest that breastfeeding is beneficial for the mother's health. For a review of the literature on the benefits of breastfeeding for mothers see Labbok (2001). The list of beneficial maternal health outcomes includes lowered risk of breast and ovarian cancers, decreased incidence of long-term osteoporosis and pregnancy-induced obesity, more rapid return to the prepartum weight, and reduced menstrual blood loss.

Reflecting research that indicates that children and mothers benefit from breastfeeding, numerous organizations and public health officials support and recommend breastfeeding. These organizations include: American Academy of Pediatrics (AAP), American Pediatrics Association (APA), American Medical Association (AMA), American Dietetic Association (ADA), American Academy of Family Physicians (AAFP), World Health Organization (WHO), and the American Public Health Association (APHA). The American Academy of Pediatrics (1997) endorses exclusive breastfeeding (i.e., without supplementation) for approximately six months after birth and recommends continued breastfeeding with supplementation until the infant is at least 12 months old. Further, the US Surgeon General states, "The nation must address these low breastfeeding rates as a public health challenge and put into place national, culturally appropriate strategies to promote breastfeeding" (US DHHS, 2000). The Federal government promotes increasing breastfeeding rates at initiation, six, and twelve months after birth to 75, 50, and 25 percent, respectively, as a *Healthy People 2010* Objective.[4]

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[2] Although the validity of some studies finding evidence that human milk has health benefits for mothers and children has been questioned, the cumulative evidence suggests the benefits are well-established.

[3] In addition to the physiological health benefits, studies suggest that human milk may also benefit children's cognitive and educational abilities. Some studies also demonstrate that breastfeeding improves a mother's sense of self-esteem, bonding with infant, and success with mothering. However, the methodological rigor of these studies is not as strong as those examining the health benefits of breastfeeding for children and mothers.

[4] See http://www.cdc.gov/nchs/about/otheract/hpdata2010/abouthp.htm for further information on *Healthy People 2010*.

2.2 Breastfeeding and Maternal Employment

Figure 1 illustrates that working full-time and breastfeeding may be competing behaviors six months after birth. In 2001, women working full-time six months after birth were approximately 11 percentage points (30 percent) less likely to breastfeed at this point in time than women not working outside the home (Ryan, 2002). Women who worked full-time one month after birth were only 1.4 percentage points (2 percent) less likely to breastfeed in the hospital, i.e., initiate breastfeeding, than non-working women. These data suggest that full-time work is weakly correlated with the initiation of breastfeeding, but strongly associated with breastfeeding duration. In contrast to working full-time, working part-time does not appear to have such a strong negative association with breastfeeding. For instance, in 2001, women who worked part-time six months after birth were only 2 percentage points less likely to breastfeed six months after birth than mothers who were not working (Ryan, 2002). In addition, women working part-time one month after birth were 3 percentage points more likely to breastfeed in the hospital than non-working mothers (Ryan, 2002).

Previous studies demonstrate a negative relationship between maternal employment and breastfeeding duration using well-known, US data sources; however, the evidence on the relationship between maternal employment and initiation is mixed (Chatterji and Frick, 2003; Roe et al., 1999; Fein and Roe, 1998; Visness and Kennedy, 1997; Lindberg, 1996). Visness and Kennedy (1997), using the 1988 National Maternal and Infant Health Survey (NMIHS), find a negative association between employment in the year after delivery and the duration of breastfeeding, but not the initiation of breastfeeding. Lindberg (1996) addresses the temporal relationship between work and breastfeeding duration by measuring both behaviors concurrently in her duration model. Using 1980 to 1986 data from the National Survey of Family Growth (NSFG), she finds that working women breastfeed for fewer months than non-working women and those who work full-time breastfeed for shorter durations than those who work part-time. In addition, she finds that non-Black women who work part-time are more likely to initiate breastfeeding than those who do not work.

In addition to examining the association between breastfeeding and both work and work intensity, Fein and Roe (1998) include maternity leave and pre-birth expectations about work in their models. Using data from the Food and Drug Administration's Infant Feeding Practices Survey (FDA-IFPS), collected between 1993 and 1994, they find that the mother's pre-birth

expectation to work full-time is negatively associated with the initiation of breastfeeding. They also find that maternity leave of six weeks or more has a positive association with the initiation of breastfeeding. Their results indicate that working full-time three months after birth has a negative relationship with the probability of breastfeeding at three months. Findings also suggest that employed mothers with no maternity leave breastfeed as long as those who do not work, but mothers with some leave had a statistically shorter duration of breastfeeding than non-working mothers. One explanation for this finding that is consistent with research by Baum (2003) is that employed mothers without leave did not return to work, but exited the labor force for a period of time.

While these studies provide important information on the relationship between maternal employment and breastfeeding, they do not address the possibility that work status and intensity of work are endogenous to breastfeeding (e.g., women who want to breastfeed may decide not to work or may choose to work part-time or "super moms" who want to succeed at everything have a great desire to both breastfeed and work). Studies by Roe et al. (1999) and Chatterji and Frick (2003) both attempt to address the endogeneity of work status and work intensity and still find negative relationships between work and work intensity, and breastfeeding. Roe et al. (1999) estimate a simultaneous model of maternal employment and breastfeeding using IFPS data. In their specification, maternal occupation and availability of any formal work leave identify the maternal employment equation, and birth and birthing characteristics identify the breastfeeding equation. They find that the shorter the duration of work leave in weeks, the shorter the duration of breastfeeding in weeks. Further, the greater the intensity of work the less frequently a mother will breastfeed her infant. Their results also indicate that breastfeeding behaviors do not significantly affect employment, thus suggesting that employment decisions are determined first. However, the results of their study hinge upon their identification assumption that occupation and availability of leave have a direct impact on employment decisions but not breastfeeding behavior. Chatterji and Frick (2003) point out that this assumption may not be valid as occupation may influence workplace characteristics (e.g., availability of personal space for expressing milk) and breastfeeding.

The most recent paper investigating the issue of maternal employment and breastfeeding by Chatterji and Frick (2003) tests whether returning to work within three months of birth and the intensity of work reduces the probability of initiating breastfeeding and the duration of

breastfeeding measured in weeks. They estimate a family-level fixed-effects model using 1974 to 1996 data from the National Longitudinal Survey of Youth 1979. They find that returning to work within three months reduces the probability of initiating breastfeeding and the duration of breastfeeding. Of those women who return to work within three months, working thirty-five hours or more reduces the probability of initiating breastfeeding and the duration of breastfeeding. This is the first study to establish a negative relationship between work and the initiation of breastfeeding for all new mothers. Their results rest on the assumption that all unobserved factors related to breastfeeding and employment characteristics remain constant between the births of children, which may not be valid. For example, a woman's views about her role as a mother and member of the labor force may change between births.

This paper contributes to this body of research along several dimensions. Little is known about what generates differences in breastfeeding practices among working women as previous studies examine the effect of working compared to not working on breastfeeding outcomes. This paper seeks to understand an underlying mechanism that may produce disparities in breastfeeding rates among women who work: workplace characteristics. The workplace characteristics studied in this paper are often mentioned by breastfeeding experts as potentially effective ways to facilitate breastfeeding and work (Meek, 2001; US DHHS, 2000; Riordan and Auerbach, 1998; Corbett-Dick and Bezek, 1997; Barber-Madden, Petschek, and Pakter, 1987; Moore and Jansa, 1987). Results from a survey conducted by Auerbach (1984) indicate that the second biggest obstacle faced by working women trying to breastfed was finding time at work to pump/express milk. Other obstacles mentioned include finding a place at work to pump, extra travel to go to baby during workday, and inability to pump at work. To my knowledge, the effectiveness of these or similar workplace characteristics has not been empirically tested.

To estimate the effects of workplace characteristics on breastfeeding, the paper also addresses whether workplace characteristics affect breastfeeding through return-to-work behavior and if workplace characteristics influence women to return to work earlier after giving birth. Hence, how to model the effect of work status and hours of work on breastfeeding decisions is considered and empirically tested. Finally, to understand the implication of these findings, the paper also considers whether workplace characteristics are endogenous to breastfeeding and conducts several exercises to gain a better understanding of how women choose their jobs in relation to fertility behavior.

3. DATA

The primary source of data is the National Longitudinal Survey of Youth 1979 (NLSY79). Information on state breastfeeding laws is from La Leche League (2001). The World Tax Database is the source of data on state sales tax rates on food, which includes infant formula.[5]

3.1 NLSY79

The NLSY79 is a longitudinal data set that has been collected by the Bureau of Labor Statistics (BLS) since 1979. Its primary purpose is to collect information on the labor force experiences of adults and young adults. The first wave of data included 12,686 young men and women who were between the ages of 14 and 21 on December 31, 1978. The original sample was designed to be nationally-representative of youth ages 14 to 21 on December 31, 1978 and included over-samples of Blacks, Hispanics, low-income Whites, and Armed Forces personnel.[6] The NLSY79 dropped most of the Armed Forces sample in 1989 and the over-sample of low-income Whites in 1993. Prior to 1994, respondents were surveyed every year. After 1994, respondents were interviewed every other year (1994, 1996, 1998, 2000). The latest wave of publicly available data was collected in 2000.[7]

There are advantages of using the NLSY79 for this research. Breastfeeding questions allow the assessment of initiation and duration of breastfeeding. In addition, the survey collects data on workplace characteristics. Information on maternal and birth characteristics identified in the literature as associated with breastfeeding rates is collected. Labor force participation information is collected for the same time period as breastfeeding data, avoiding the problem of time invariance between employment and breastfeeding highlighted by Lindberg (1996).[8] Geocoded data include state-level identifiers, thereby allowing linking with state-level contextual

[5] The World Tax Database is available on-line at http://wtdb.org/index.html. Data for this paper were extracted in June 2003.

[6] Results are reported including respondents in the over-samples. Models were also estimated excluding respondents in the over-samples and the results are qualitatively similar to those presented. The primary difference is that upon excluding the over-samples, the effect of returning to work within three months on the initiation of breastfeeding is statistically significant.

[7] The Center for Human Resource Research (2001) provides further information on the NLSY79 sample design and survey content.

[8] Mothers are asked what week after birth they returned to work and what week they weaned their infant.

data. Finally, the longitudinal nature of the data facilitates tracing key variables over time such as women's employment and fertility.

Information on two aspects of breastfeeding is collected: whether the mother ever breastfed and the duration of breastfeeding.[9] Female respondents who recently gave birth are asked "When *biological child's name* was an infant did you breast feed him/her at all?"[10] If a female respondent answered that she ever breastfed her child, she was asked "How many weeks old was *biological child's name* when you quit breastfeeding him/her altogether?" Respondents answered in weeks or months. NLSY79 converted all responses to weeks assuming that there are four weeks in a month.

Given that the primary motivation of the NLSY79 is to understand labor market experiences, the data on employment are extremely rich. Work histories are compiled for each respondent, which include detailed information about the respondent and the respondent's employer. Of particular interest to this study are the questions about workplace characteristics. The question on hours worked at home asks, "How many hours per week (do/did) you usually work at this job at home?" The question about flexible schedules asks respondents, "Does/did your employer make available to you flexible hours or work schedule?" The survey question on child care asks, "Does/did your employer make available to you company provided or subsidized child care?" Finally, the question on type of schedule worked asks the respondent, "Which of the following categories best describes the hours you work/worked at this job?" Respondents could choose one of the following responses: regular day shift, regular evening shift, regular night shift, shift rotates, spilt shift, irregular hours, and other.[11]

Despite the wealth of information collected by the NLSY79, there are four primary limitations of using these data for this study. First, because the survey was administered every other year beginning in 1994, some maternal information for births in odd years is extracted from the following survey after birth with the assumption that the characteristics remain constant. While most maternal characteristics are fixed (e.g., race/ethnicity and country of birth) or can be accurately derived (e.g., maternal age and receive any public assistance), this survey administration feature could affect variables such as maternal education, presence of

[9] NLSY79 stopped collecting data on the exclusivity of breastfeeding (i.e., breastfeeding without supplementation) in 1991.
[10] Respondents were asked about multiple births and adopted out/deceased children.
[11] Prior to 1990, the respondent only had two possible answer choices: same/fixed shift and shift rotates.

spouse/husband, family size, and region of residence. Descriptions of each variable, which also include information on the measurement of each variable relative to the timing of the birth, is presented in Table A1. While some data on workplace characteristics are collected in the NLSY79, information on additional workplace characteristics would have been beneficial this study. Relevant additional workplace characteristics might include: availability of a lactation room, office with a door, and a job-sharing policy. Third, in some survey waves questions on fringe benefits, which include questions on the availability of a flexible schedule and employer-sponsored child care, were only asked of respondents who worked 20 hours a week or more; therefore observations were excluded to maintain a consistent definition of the sample over time. Finally, these data are not representative of a current cross-section of births to all US mothers or US working mothers.[12]

3.2 Analysis Sample

The analysis sample includes births to female respondents between 1988 and 1999.[13] The following two criteria are used to select births for inclusion in the analysis sample. First, the mother who gave birth must have typically worked 20 hours a week or more six months prior to the birth. The reasoning behind this inclusion criterion is twofold. Employment six months prior to birth is commonly used as a measure of a woman's labor force status and attachment before childbirth (for example, Waldfogel, 1997; Shapiro and Mott, 1994). Questions about fringe benefits were not administered to respondents who worked less than 20 hours per week until 1994. To maintain consistency in the sample over years, I limit the sample to women who typically worked 20 hours a week or more before giving birth. The second inclusion criterion is that the mother responded to survey questions on the initiation and duration of breastfeeding, workplace characteristics, work status, state of residence, and availability of employer-sponsored health and dental insurance.[14] The final sample is comprised of 1,482 births out of the 3,503

[12] The sample was designed to be nationally-representative of youth ages 14 to 21 on December 31, 1978 and has not been refreshed.
[13] Although data on 2000 births are available, I exclude them to ensure complete breastfeeding spells for all births.
[14] Other missing values are assigned the unconditional mean of the variable, calculated on the remaining observations with non-missing data. Variables with imputed values include (number imputed): maternal education (1), receipt of public assistance (23), AFQT score (43), smoke (170), low birth-weight (165), and caesarean section performed (180). I also estimate the recursive bivariate probit models excluding observations with missing values and the results are qualitatively similar. The primary difference is that upon excluding observations with missing values, the effect of returning to work within three months on the initiation of breastfeeding is statistically significant and the effect of returning to work within six months on breastfeeding at six months is not.

births (42.3 percent) that occurred between 1988 and 1999.[15] Thirty-two percent (1,128 of 3,503) of the births were excluded because the expecting mothers were not working at least six months prior to delivery.

The 1,482 births that comprise the analysis sample belong to 1,170 female respondents. Of the 1,170 mothers, 895 have one child and 275 have multiple children. Of those mothers with multiple children, 243 mothers have two births included in the sample, 28 mothers have three births, 3 mothers have four births, and 1 mother has five births. In addition, 55 births (one set of triplets) are part of multiple births.

Table 1 presents characteristics of the analysis sample. From this table, key points emerge that are relevant to the analyses and the interpretation of results. First, 59.6 percent of the sample initiate breastfeeding and 19.5 percent are breastfeeding at six months. These statistics illustrate that breastfeeding prevalence rates decrease after birth and reach low levels (approximately one-fifth of the sample) six months after birth. Second, variation exists among respondents' workplace characteristics. Approximately 15.5 percent of respondents work any hours at home, 52.4 percent have a flexible schedule available, 10.3 percent have employer-sponsored child care available, and 8.5 work a rotating shift. Finally, this sample is more educated and older relative to the mean education and age for all US births during the same time period. The mean age of US mothers between 1988 and 1999 ranged from 26.3 to 27.1 compared to the sample mean age of 31.4 (Mathews and Hamilton, 2002). In addition, between 1988 and 1999, 20.4 percent to 23.9 percent of births were to mothers without a high school degree compared to 9.5 percent of births in the sample (NCHS, 2001). Further, between 1990 and 2000 between 17.4 percent and 24.1 percent of births were to mothers with a college degree compared to 30.6 percent of births in the sample (NCHS, 2001).

[15] Of the 3,503 births that occurred between 1989 and 1999, 2,021 (57.7 percent) are excluded from the analysis sample. 1,128 births are excluded because respondents did not work six months before birth. An additional 315 births are excluded because respondents did not answer at least one of the two breastfeeding questions. The remaining 578 births are excluded because they are missing information on workplace characteristics, work status, state of residence, or availability of employer-sponsored health or dental insurance. The births excluded because of missing data are statistically different from the included births along several dimensions, which include some key predictors of breastfeeding. Excluded births are more likely to be White, less likely to be Black, more likely to be younger, more likely to have more family members, more likely have a spouse or partner present, more likely to reside in the Northeast, less likely to reside in the South, less likely to be born in the US, and more likely to receive public assistance.

4. EMPRICAL STRATEGY

This paper tests the hypothesis that selected workplace characteristics decrease (increase) the time cost of work and breastfeeding, therefore increasing (decreasing) the probability that an individual decides to initiate breastfeeding and breastfeed at six months. Given that work has a negative effect on breastfeeding, workplace characteristics may also affect breastfeeding through the speed with which the mother returns to work.[16] One might hypothesize that those mothers with favorable workplace characteristics return to work earlier than those with unfavorable characteristics. To estimate the direct effects of workplace characteristics on breastfeeding, it is necessary to include work as an explanatory variable to control for the effect of return-to-work behavior on breastfeeding. However, it is highly likely that work is endogenous to breastfeeding decisions and the estimate of work biased. For example, women with a high desire to breastfeed may choose not to return to work to ensure enough time to breastfeed. Hence, estimating a probit model is not appropriate.

To address the potential endogeneity of work status, I estimate a recursive bivariate probit model (See Greene (2000).).[17] I choose a recursive bivariate probit model over the more commonly used two-stage least squares (2SLS) model because the outcomes are both binary and not continuous. A true simultaneous equation model is not appropriate because a true simultaneous equation model requires both equations to be autonomous or self-contained (See Woolridge (2002).). For the breastfeeding and work equations to be autonomous, I would have to estimate the causal effect of wages on breastfeeding holding all other variables constant. I do not believe that the estimated effect of wages on breastfeeding holding work level, for example, constant is the true effect as women would most likely also adjust their time spent at work. Furthermore, I prefer to estimate a recursive bivariate probit model over a two-step procedure for three reasons. First, it has been shown that the two-stage procedure does not, in general, produce the structural parameter of interest with a few notable exceptions (Bhattacharya, McCaffrey, and Goldman, 1999). According to Greene (2000), one can perform a two-step estimation procedure and get consistent but potentially inefficient results. A final motivation for using the recursive

[16] It is also possible that workplace characteristics may affect breastfeeding through work intensity. However, work intensity is not included in this model because breastfeeding can be viewed as a direct function of hours of work and therefore locating a valid instrument for hours of work has not been possible.

[17] The difference between a recursive bivariate probit and a bivariate probit is that the recursive bivariate probit includes one of the outcomes as an explanatory variable in the equation of the other outcome.

bivariate probit model is that it allows me to easily test the correlation between the error terms in the two equations after controlling for the included variables. This test will provide information on whether the unobservable characteristics of work and breastfeeding decisions are related.

I use a latent variable model to estimate the decision to breastfeed (Equation 1).

$$BF_i^* = B_0 + B_1 WC_i + B_2 W_i + B_3 X_i + B_4 Y_i + \varepsilon_i \qquad [1]$$

In this model BF_i^* is the mother's latent propensity to breastfeed at a particular point; WC is a vector of workplace characteristics; W is work status; X is a vector of maternal and birth characteristics; Y is a vector of contextual data; and ε_i is a normally distributed random error. The unit of analysis, i, is a birth. The propensity of a mother to breastfeed at any point is unobserved; however, when $BF_i^* > 0$ then the mother is observed breastfeeding at a particular point and $BF_i = 1$. To determine the effect of workplace characteristics on the probability of breastfeeding I estimate Equation 2 as part of a recursive bivariate probit model.

$$Prob(BF_i = 1) = Prob(BF_i^* > 0) = Prob(B_0 + B_1 WC_i + B_2 W_i + B_3 X_i + B_4 Y_i > 0) = \Phi(B_0 + B_1 WC_i + B_2 W_i + B_3 X_i + B_4 Y_i) \qquad [2]$$

In this equation, Φ is the standard normal cumulative distribution function.

I use a latent variable model to estimate the decision to return to work within three or six months after birth (Equation 3).

$$W_i^* = B_0 + B_1 WC_i + B_2 X_i + B_3 Y_i + B_4 H_i + \mu_i \qquad [3]$$

In this model W_i^* is the mother's latent propensity to return to work, H is a vector of instruments, and μ_i is a normally distributed random error. The remaining categories (WC, X, and Y) of variables are identical to those included in the breastfeeding equation. Again, the unit of analysis, i, is a birth. The propensity of a mother to work at any point is unobserved; however, when $W_i^* > 0$ then the mother is observed working and $W_i = 1$. The second equation estimated as part of the recursive bivariate probit model is shown in Equation 4.

$$Prob(W_i = 1) = Prob(W_i^* > 0) = Prob(B_0 + B_1 WC_i + B_2 X_i + B_3 Y_i + B_4 H_i > 0) = \Phi(B_0 + B_1 WC_i + B_2 X_i + B_3 Y_i + B_4 H_i) \qquad [4]$$

Again, Φ is the standard normal cumulative distribution function. The error terms in Equations 1 and 3, ε_i and μ_i, are joint normally distributed and the correlation between them is $\text{cov}[\varepsilon_i, \mu_i] = \rho$.

Breastfeeding (BF)

The two dependent variables are indicators for whether the infant was ever breastfed and whether the infant was breastfed to six months.[18] I specify the breastfeeding variables as dichotomous because I am interested in examining how workplace characteristics affect reaching breastfeeding objectives.[19] Ever breastfed, i.e., initiation of breastfeeding, equals one if the mother breastfed for at least one week and equals zero if she did not. While information is available from the initiation question to determine if a mother ever breastfed, I choose not to use it because it is unclear what it means to start breastfeeding and not breastfeed for at least one week.[20] In addition, other studies (Chatterji and Frick; 2003; Chatterji et al. 2002) have defined initiation in a similar manner. I estimated models using both definitions of initiation and the results are similar.

The second dependent variable is whether the mother breastfed her infant for six months or longer. The entire sample is included in the analyses examining this outcome. Those who did not initiate are coded as zeroes because analyses suggest that decisions to initiate breastfeeding and continue breastfeeding to six months conditional on initiation are influenced by similar factors.[21] Six months is chosen as an outcome of interest because the American Association of Pediatrics (1997) recommends that new mothers breastfeed exclusively, without supplementation, for at least six months after birth. In addition, a recent Cochrane Collaboration review of studies investigating the benefits of breastfeeding found that the scientific evidence supports six months as the optimal duration of exclusive breastfeeding (Kramer and Kakuma, 2003).

Workplace characteristics (WC)

The first workplace characteristic considered is the number of hours a woman works at

[18] Both outcome variables implicitly include milk expressed and fed to the infant with a bottle.
[19] If I was not interested in answering this particular question, I would consider estimating a hazard model predicting the probability of weaning in each time period.
[20] It is unclear how many births this is relevant for because interviewers do not receive explicit instructions about how to handle a situation where a mother reports breastfeeding for less than one week. Some interviewers might code this information as one week; others might change the answer to the ever breastfeeding question to no (Keck, 1997).
[21] I assessed this by comparing the explanatory variables of a model with initiation as the outcome and breastfeeding at six months conditional on initiation as the outcome. Because the explanatory variables of both outcomes were similar, I used breastfeeding at six months not conditional on initiation as the specification for this outcome to maintain larger sample sizes. The findings of this exploration are available upon request from the author.

home on a weekly basis. Working at home allows mothers to avoid the costs of commuting to work and preparing for work (e.g., dressing and packing personal items). Given that working at home reduces the total amount of hours spent on work-related activities, one would expect that allowing employees to work at home would increase a new mother's propensity to breastfeed. In addition, it could reduce the cost of breastfeeding because the mother is in the same location as the child and does not need to either travel to breastfeed her infant or spend time pumping and storing the breast milk.

The second characteristic examined is the availability of a flexible schedule. Flexible scheduling is defined as any benefit or policy that allows an employee to vary her work schedule or hours. Such policies include allowing employees to work hours outside the typical workday or to take ample breaks to express pump or breastfeed. This policy reduces the cost of breastfeeding and working, and is expected to increase a new mother's probability of breastfeeding.

The third variable examined is the availability of employer-sponsored child care. Employer-sponsored child care is typically provided on-site or close to the employment site, therefore reducing the time cost of breastfeeding and working. The final workplace characteristic included is working a rotating work schedule, which is defined as working a rotating shift that periodically changes from evening to day shifts, irregular shifts that are scheduled to fit the needs of employers, or any other shift that is not fixed. Working a rotating schedule increases the time cost of breastfeeding and working because it involves uncertainty in schedules. Such uncertainty hinders a new mother when establishing a schedule of breastfeeding or pumping, which makes breastfeeding more difficult.

These four workplace characteristics have advantages and disadvantages that are important to the interpretation of their effects. First, both hours worked at home and work a rotating schedule are behaviors; therefore, they are more likely to be endogenous to breastfeeding decisions than the availability of a flexible schedule or employer-sponsored child care. Additionally, the marginal effects of these behavioral variables do not answer the policy question of what would be the effect on breastfeeding of allowing women to work at home or work a rotating schedule. Conversely, the estimates of availability of flexible schedule and employer-sponsored child care can inform policymakers of the effect on breastfeeding of making flexible schedules and child care available. Another limitation of these two variables is they may undercount the number of women who are allowed to work a flexible schedule or have child care

available at work because a respondent may not be aware of these benefits. For example, Waldfogel finds that more than half of employees in both covered and non-covered institutions did not know whether the Family and Medical Leave Act (FMLA) of 1993 applied to them (2001).

Work status (W)

Two work status variables are included in these analyses. The work status variable included in the initiation of breastfeeding model is return to work within three months. This measure is used because three months is the amount of unpaid leave guaranteed under FMLA. The work status variable included in the breastfeeding at six months model is return to work within six months.

Maternal and birth (X), and contextual (Y) variables

To specify this model parsimoniously, I choose covariates that are 1) strong predictors of breastfeeding in other studies and 2) typically correlated with workplace characteristics. The inclusion of variables correlated with both breastfeeding and workplace characteristics reduces the likelihood that the estimates of workplace characteristics are biased, if the included variables are properly specified. The following paragraphs discuss the explanatory variables and their predicted relationships with breastfeeding behavior.[22]

Maternal characteristics (*X*) include age, race/ethnicity dummy variables (non-Hispanic White, non-Hispanic-Black, and Hispanic), born in the US, education dummy variables (no college, some college, and college graduate), Armed Forces Qualification Test (AFQT) score, whether the mother smoked in the year before birth, receipt of any public assistance, family size, and presence of spouse or partner of the opposite sex. The associations between the following maternal characteristics and breastfeeding practices have been consistently demonstrated in the literature. Older mothers are more likely to breastfeed their children and for longer periods than younger mothers (e.g., Visness and Kennedy, 1997; Lindberg, 1996; Peterson and DaVanzo, 1992). White mothers are more likely to breastfeed than Black mothers (e.g., Forste, Weiss, and Lippincott, 2001; Kurinj, Shiono, and Rhoads, 1988). Women who are born in the US are less likely to breastfeed their infants than those who are born outside of the US (e.g., Forste, Weiss,

[22] Slusser and Lange (2002) provide a comprehensive review of the determinants of breastfeeding.

and Lippincott, 2001; Baydar et al., 1997). More educated mothers are more likely to breastfeed their infants (e.g., Fein and Roe, 1998; Lindberg, 1996). In addition, mothers with higher AFQT scores are more likely to breastfeed their children (e.g., Chatterji and Frick, 2003; Chatterji et al., 2002). AFQT score is a measure of basic skills and is included as a proxy for the ability to process information on breastfeeding.[23] It is different from education in that education measures formal training received, while AFQT score reflects abilities. Women who smoke are less likely to breastfeed their infants than mothers who do not (e.g., Chatterji and Frick, 2003; Chatterji et al., 2002).[24] Smoking is included as a proxy of a mother's willingness to invest in her children's health or her awareness of what constitutes healthy and unhealthy behaviors.

Unlike the previous maternal characteristics, the association between the following variables and breastfeeding has not been consistently demonstrated. The effect of receipt of public assistance is ambiguous because it represents poverty, which is often associated with lower breastfeeding rates. Further, those with lower-income may receive WIC, which discourages breastfeeding through the provision of free formula. In contrast, those who receive public assistance may also receive additional income, which is generally associated with higher breastfeeding rates. Family size is included to capture a mother's other household duties.[25] It is unclear whether a larger family is positively or negatively associated with breastfeeding. A larger family is more likely to create more work for the mother; however, with a larger family the mother may have more helpers. Similarly, the presence of a spouse or partner could translate into more assistance with household duties and feeding. The presence of a spouse or partner also represents a potential additional income source in the household and higher income is positively correlated with breastfeeding. Conversely, studies have found that spouses' and partners' negative views (real or perceived) about breastfeeding can hinder breastfeeding efforts by new mothers (See Bar-Yam and Darby (1997) for a review of this literature.).

Birth characteristics capture the circumstances surrounding the birth, which may

[23] AFQT score is a test used by the armed forces to determine enlistment decisions. Its main goal is to measure trainability and a recruit's ability to finish the training program. I use the AFQT scores revised in 1989, which are based on tests of word knowledge, paragraph comprehension, math knowledge, and arithmetic reasoning. The word knowledge and paragraph comprehension section contribute twice as much to the final score as the two math sections.

[24] 11.5 percent of the values of the smoking variable are missing. Hence, I include a binary variable to indicate if a value is missing.

[25] Different specifications of household size and composition were considered such as number of children ages zero to two, number of children ages three to five, number of children six to eleven, and number of adults. The inclusion of different specifications did not change the results.

influence a woman's decision or ability to breastfeed.[26] Studies find that delivering a low birth-weight infant has a negative effect on breastfeeding (e.g., Chatterji and Frick, 2003; Chatterji et al. 2002).[27] It may be negative because low birth-weight infants tend to stay in the hospital longer, which makes it harder for the mother to breastfeed her infant. In addition, delivering a low-birth weight baby may capture other factors such as poor prenatal care attributable low investment in children's well-being. Studies report mixed results of having a c-section or a first birth on breastfeeding.[28] One might expect undergoing a c-section to decrease breastfeeding as women who have a c-section may delay initiation of breastfeeding making it harder to successfully initiate (Riordan and Auerbach, 1998). For example, if a mother underwent a caesarean section (c-section), she may not be able to breastfeed her child shortly after birth. Delaying the first breastfeeding makes it more difficult to successfully initiate breastfeeding (Riordan and Auerbach, 1998). It is possible that mothers are more likely to breastfeed first births because they are more anxious about them. It is also possible that they are less likely to breastfeed them because they have less information on the benefits of breastfeeding. The effect of having a multiple birth on breastfeeding is expected to be negative; however, to my knowledge, no study has been conducted showing this.

The motivation behind the inclusion of the vector of contextual variables (Y) is to control for factors external to the household that may affect breastfeeding decisions. Contextual variables included in the models are regional dummy variables, two state breastfeeding laws, state tax rates on food, and year fixed effects. Women who live in the West are more likely to breastfeed than mothers residing in other regions in the United States (e.g., Chatterji et al., 2002; Forste, Weiss, and Lippincott, 2001). Laws intended to facilitate breastfeeding were passed in some states during the 1990s (La Leche League, 2001). Table A2 provides information on these laws by state. The first law of interest clarifies that mothers are permitted to breastfeed in public areas. This law could reflect favorable public attitudes regarding breastfeeding in the state or

[26] NLSY79 asks female respondents about other conditions that would be good measures of the difficulty of birth such as gestational age and number of days the mother and infant spent in the hospital after birth. Each of these variables has a substantial number of missing values; therefore, I can not use them in my regression models. For the analysis sample, 66 percent of births are missing values on gestational age and approximately 21 percent of values are missing for mothers' and infants' lengths of hospital stays.

[27] Eleven percent of the low birth-weight values are missing. Hence, I include a binary variable to indicate if a value is missing.

[28] Twelve percent of the cesarean section values are missing. Hence, I include a binary variable to indicate if a value is missing.

address negative actions against mothers breastfeeding in public places by the public or law officials. The second law aims to accommodate breastfeeding in the workplace. The stipulations of the workplace law vary among states, from acknowledging the importance of allowing employees to breastfeed at work, to requiring employers to allow mothers to breastfeed at work and make appropriate accommodations for them. I rely on two indicator variables to capture the existence of these two laws.

In addition, I include state sales tax rates on food as an explanatory variable reflecting the different formula prices that an individual may face depending upon the state where they reside and the year of birth.[29] To my knowledge, this is the first study to include this variable in the analysis of breastfeeding decisions. Over the relevant time period the state sales tax rate on food ranges from zero percent in states with no sales tax or exempt taxes on food to seven percent in Mississippi (See Table A2.). An individual may purchase formula in a state other than the one in which they reside; however, such information is not collected by the NLSY79. Finally, the year fixed effects capture changes over time that may affect breastfeeding practices across all states. For example, national breastfeeding informational campaigns by the US Surgeon General would be captured by such a variable. Because breastfeeding rates increased from 1989 to 1999, one would expect the coefficients on the year fixed effects to be negative compared to the excluded year, 1999.

Instruments (H) and their validity

To identify the model, at least one variable must be included in the work equation that is not part of the breastfeeding equation. The variables in the vector of instruments (*H*) serve this purpose: the availability of health insurance from the employer and the availability of dental insurance from the employer.[30] As shown in Table 1, 78.7 percent of the sample has employer-sponsored health insurance available and 64.4 percent has employer-sponsored dental insurance available. The correlation between these two variables is 0.56 with a p-value of 0.0000.

[29] No state with a sales tax on food has an exemption for infant formula.

[30] The question on the availability of health insurance asks the respondent "Does/Did your employer make available to you *Do/Did you have available to you* medical, surgical, or hospital insurance that covers injuries or major illnesses off the job?" The survey question on dental insurance is "Does/Did your employer make available to you *Do/Did you have available to you* dental benefits?" Although both questions appear to ask about the availability of any health or dental insurance, they are asked as part of a series of questions on employer-provided benefits.

For an instrument to be valid it must meet two conditions 1) be a determinant of the decision to work after birth, and (2) not be a determinant of the decision to breastfeed, i.e., must not be correlated with error term in the breastfeeding equation (ε_i). It is likely that women with employer-sponsored health and dental insurance return to work earlier as many jobs do not pay for insurance coverage while women are on unpaid leave. Table 2a shows that that the availability of health insurance and dental insurance are strong correlates of returning to work. Those with employer-sponsored health insurance available are significantly more likely to return to work within three and six months after birth than those without insurance available. Those with employer-sponsored dental insurance available are also significantly more likely to return to work within three and six months after birth than those without dental insurance available. In addition, the availability of employer-sponsored health insurance is positive and significant at the 0.01 level in the model with return to work within three months as the outcome (See Table 4.). Both the instrumental variables are significant with the predicted sign, positive, at the 0.01 level in the models predicting return to work within six months (See Table 5.). Finally, similar to Evans and Schwab (1995) and Mellor (1998), I estimate 2SLS models and calculate the F-statistics for the joint significance of the instruments. The F-statistic in the model with return to work within three months as the outcome is $F(2, 1{,}445) = 8.24$ with a p-value of 0.0003. In the model with return to work within six months as the outcome the F-statistic is $F(2, 1{,}445) = 23.19$ with a p-value of 0.0000.

Theoretical and empirical evidence suggest that the availability of health and dental insurance are not predictors of breastfeeding behavior. There is no reason to believe that the availability of dental insurance or even having dental insurance should affect breastfeeding decisions. In the case of the influence of the availability of health insurance on breastfeeding, one might argue that the availability of health insurance is correlated with having health insurance and having health insurance may translate into a greater likelihood of receiving attention from a health care professional, who would discuss the benefits of breastfeeding with an expecting or new mother. While the availability of health insurance may lead to a higher probability of having health insurance and receiving health care attention, receiving health care attention does not necessarily translate into higher breastfeeding rates as studies show that medical professionals have little influence on breastfeeding decisions (See Riordan and Auerbach (1998).). In addition, research shows that medical doctors do not do enough to

promote breastfeeding or have ample knowledge of the subject (Schanler, O'Connor, and Lawrence, 1999; Freed et al., 1995a; Freed et al., 1995b). If one was to argue that having health insurance provides greater access to other breastfeeding support services, a counterargument is that those who do not have health insurance available through work may receive lactation services through programs such as WIC and Medicaid.

Second, Table 2b shows that only two statistically significant differences exist in breastfeeding rates between those with dental insurance available and those without dental insurance available and those with health insurance available and those without health insurance available. First, those without employer-sponsored health insurance are more likely to breastfeed at six months after birth than those with health insurance available. The most likely explanation for this relationship is that the availability of employer-sponsored health insurance captures some of the effect of work on breastfeeding. After controlling for work, the relationship between breastfeeding and the availability of employer-sponsored health care dissipates. The second difference is that those with employer-sponsored dental insurance are more likely to initiate breastfeeding. The most plausible explanation for this relationship is that women with dental insurance available share the same demographic characteristics with those who are more likely to breastfeed. Upon controlling for demographic characteristics, this relationship dissipates as well. Finally, I fail to reject the null hypothesis, zero correlation between the instruments and the error terms of the breastfeeding equations, of the overidentification tests estimated using 2SLS. The p-value of the overidentification test is 0.153 in the initiation model and 0.802 in the model examining breastfeeding at six months.

Estimates are unweighted.[31] In addition, standard errors are clustered by the mother because multiple births to mothers are included in the analysis samples and are probably not independent. Previous research shows that women tend to repeat decisions to breastfeed or not breastfeed their children (DaVanzo, Starbird, and Leibowitz, 1990).

[31] I control for many of the characteristics used to create the NLSY79 weights; therefore, not weighting the data should not affect my results. I test this by estimating models using the 1989 respondent sample weights and the results are qualitatively similar to those presented in this paper.

5. RESULTS

Table 3 presents the gross relationship between each workplace characteristic and breastfeeding outcome. These statistics illustrate a statistically significant relationship between working any hours at home and breastfeeding outcomes. Women who work any number of hours at home are 18.4 percentage points more likely to initiate breastfeeding and 13 percentage points more likely to breastfeed six months after birth than those who do not work any hours at home. In addition, those mothers with employer-sponsored child care available are 13 percentage points more likely to breastfeed six months after birth relative to mothers without such child care available. The difference in breastfeeding initiation rates between those with and without employer-sponsored child care is not statistically significant.

The differences in breastfeeding rates between those with and without the two remaining workplace characteristics are not statistically significant; however, the directions of some of these associations are unexpected. Women with a flexible schedule available are less likely to breastfeed six months after birth than their counterparts without a flexible schedule available. The direction of the association between working a rotating schedule and the initiation of breastfeeding is positive, which is the opposite of what I predicted. These relationships are explored in greater depth later in the paper using multivariate techniques.

Table 3 also illustrates that some women are more likely to have jobs with these workplace characteristics than others. Differences are most evident between women who work at home and those who do not with women who work at home more likely to be non-Hispanic White, have more education, and higher AFQT scores. Women who work at home are less likely to be non-Hispanic Black, Hispanic, and receiving public assistance. In addition, women who work at home are more than twice as likely to be in a professional position, more than half as likely to be in a clerical position, and almost twice as likely to be self-employed than those who do not work any hours at home. Differences between those working in jobs with and without the remaining three characteristics are not as striking; although, one particular association is worth highlighting as it enhances the understanding of these workplace characteristics. Availability of a flexible schedule is strongly correlated with working a rotating schedule, as those with a flexible schedule available are more than 300 percent more likely to work a rotating schedule than those without one available. In addition, those who work a rotating schedule are more than 50 percent

more likely to have a flexible schedule available than those who work a fixed schedule. The correlation is 0.13 with a p-value of 0.0000. Given this association, it is possible that the distinction between having a flexible schedule available and working a rotating schedule was not clear to respondents.

Multivariate analyses: workplace characteristics

Because some women are more likely to possess workplace characteristics than others, multivariate analyses are conducted to examine whether the gross relationships persist between breastfeeding outcomes and workplace characteristics after controlling for additional factors. The results from these analyses are presented in Tables 4 and 5. Based on the descriptive statistics, it is not unexpected that a positive significant relationship between breastfeeding outcomes and hours worked at home is detected in the multivariate analyses. The marginal effects of hours worked at home on the initiation of breastfeeding and breastfeeding at six months are 0.007 and 0.005, respectively. While the marginal effect of working an additional hour at home is larger, it is important to note that breastfeeding initiation is more common than breastfeeding at six months, with rates 59.6 percent and 19.5 percent, respectively. Therefore an additional eight hours a mother works at home per week compared to not working at home increases her probability of breastfeeding at initiation by 5.6 percentage points (9.4 percent) and by 4.0 percentage points (20.5 percent) six months after birth.

The estimate of the effect of employer-sponsored child care availability on breastfeeding initiation is not statistically significant; however, the marginal effect of the availability of child care on breastfeeding at six months is both large and statistically significant. The availability of employer-sponsored child care increases the probability of breastfeeding at six months by 11.4 percentage points (58.5 percent).

As suggested by the descriptive statistics, neither the availability of a flexible schedule nor working a rotating schedule have a significant effect on either breastfeeding outcome. As predicted the direction of the relationship between working a rotating schedule and the breastfeeding outcomes is negative. The effect of having a flexible schedule available on breastfeeding initiation is positive and is negative when the outcome is breastfeeding at six months. One explanation for this unpredicted, negative marginal effect that is consistent with the descriptive statistics is that the question is unclear and more respondents reported having a

flexible schedule available than really do. Hence, this question may be capturing another concept such as personal leave. Fifty-five percent of the full sample answered that they have a flexible schedule available to them, which is approximately twice the size of the national estimate. Using the 1997 Current Population Survey (CPS), Beers (2000) estimates that 26.2 percent of women 16 and older have some form of flexible schedule available to them. Although findings from the NLSY79 and data from the CPS are not directly comparable, it seems highly unlikely that differences in sample composition explain all of these discrepancies.

Results from the return-to-work equations in Tables 4 and 5 illustrate that the majority of the effect of workplace characteristics is directly on breastfeeding behavior and does not occur through return-to-work behavior. The marginal effects of all of the workplace characteristics on returning to work within three and six months are statistically insignificant with the exception of hours worked at home in the breastfeeding initiation model. Its magnitude is small (0.007) suggesting that for every additional eight hours a mother works at home per week the probability that she will return to work within three months increases by 5.6 percentage points (7.7 percent). Additional evidence supporting this conclusion is that the marginal effects generated from probit models that do not control for work status are quite similar to those shown in the paper.[32]

The small magnitude of the effect of workplace characteristics on return-to-work implies that the provision of workplace characteristics does not provide an incentive for new mothers to return to work earlier or remain in the labor force.[33] Because most women who return to work within three or six months, I also examine if these workplace characteristics have an effect on returning to work within six weeks after birth and the only workplace characteristic that affects this outcome is hours worked at home.

Multivariate analyses: work status

These analyses also contribute to the previously discussed literature on maternal employment and breastfeeding. The marginal effect of returning to work within three months on the initiation of breastfeeding is -26.3 percentage points; however it is not statistically significant. The statistical insignificance of the effect of returning to work on the initiation of breastfeeding contradicts the significant effect found by Chatterji and Frick (2003). The marginal

[32] Results from these models are available from the author.
[33] If a woman does not return to work within six months, she will spend, on average, 2 years out of the labor force.

effect of returning to work within six months on breastfeeding at six months is -39.0 percentage points and significant, which is consistent with the findings of past studies. Table A3 reports that estimates from single-equation probit models of returning to work within three and six months on breastfeeding outcomes are greater than those generated from the recursive bivariate probit models, which contradicts the common hypothesis of negative selection. Consistent with the larger estimates from the single-equation probit models is an estimated positive covariance between the error terms.[34] Hence the unobservables positively influence both returning to work and breastfeeding, which may be capturing the "super mom" phenomenon.

Multivariate analyses: additional findings

Of the explanatory variables with previously demonstrated relationships with breastfeeding, the following are statistically significant with the expected signs while the remaining variables are not statistically significant. Women with no college compared to having a college degree, who smoke, or have low birth-weight infants are significantly less likely to breastfeed. Residing in West in relation to residing in Midwest and having a higher AFQT score are significantly associated with an increased likelihood of breastfeeding.

Low birth-weight infant, one of the unpredicted variables, is negative and statistically significant. Hence, this variable is capturing either a mother's low investment in her infant's well-being or time spent apart by the mother and the infant, which makes breastfeeding more difficult.

Of the explanatory variables that are not statistically significant, two are worth highlighting: race/ethnicity and age. The effect of being non-Hispanic Black in relation to being non-Hispanic White is not as large as expected. This is somewhat surprising given that the literature documents large differences in breastfeeding rates between different race/ethnicities, with non-Hispanic Blacks having much lower rates than other groups. Upon comparing models with and without AFQT scores, I find that AFQT scores explain a large portion of these differences in breastfeeding rates by race/ethnicity. In regressions not shown here for

[34] While these measure of ρ are appropriate for the models specified, one should be cautious in interpreting them. Estimating the same bivariate probit models without work on the right hand side of the breastfeeding equations produces very different values of ρ. The estimate of ρ in the breastfeeding initiation model is -0.0901 and the Wald test fails to reject the null hypothesis that $\rho = 0$ (p-value = 0.0690). The estimate of ρ in the breastfeeding at six months equation is negative (-0.208); however, the Wald test rejects the null hypothesis that $\rho = 0$ (p-value = 0.0022).

breastfeeding initiation and at six months, AFQT percentile scores explain approximately 50 percent of this gap. Age has no effect on any of the breastfeeding outcomes.[35] This is unusual given the consensus in the literature that older women are more likely to breastfeed. However, it is not surprising given that there is less variation in maternal age in this sample than at the national-level.

The marginal effects of the breastfeeding laws on breastfeeding outcomes suggest they are not achieving their goals of increasing breastfeeding. The marginal effect of the employment breastfeeding law is large, positive, and statistically significant in the breastfeeding initiation model and negative in the breastfeeding at six months model. This law influences breastfeeding initiation but not breastfeeding duration, which is the outcome one would expect it to affect given its purpose is to influence employer's attitudes toward and accommodations of breastfeeding. In contrast, the marginal effects of the public law are negative and insignificant in the initiation and positive and insignificant in the breastfeeding at six month model. Overall, these results suggest that the public breastfeeding laws do not influence breastfeeding rates. However, these findings should be interpreted with caution as these laws may be endogenous to breastfeeding (e.g., some states that passed laws may have done so because their breastfeeding rates are low).

6. EXPLORING THE ENDOGENEITY OF WORKPLACE CHARACTERICS

This paper estimates the effects of selected workplace characteristics on breastfeeding outcomes. Because women who want to work and breastfeed may seek jobs with workplace characteristics facilitating breastfeeding, workplace characteristics may be endogenous to breastfeeding and the effects of workplace characteristics on breastfeeding overestimated. For example, women with a higher propensity to breastfeed and work after birth may choose jobs that possess characteristics that facilitate breastfeeding and working, thus biasing the marginal effects of workplace characteristics upwards. Because measures of breastfeeding desires are not available in the NLSY79, this exploration of the endogneity of workplace characteristics to breastfeeding focuses of women's job selections around the time of birth.

[35] Models using a non-linear specification of age were estimated and age still did not have an effect on breastfeeding. AFQT scores are not age adjusted and therefore may be capturing age effects. However, age did not have a significant affect on breastfeeding when AFQT scores were excluded.

To reduce the likelihood that all workplace characteristics are endogenous to breastfeeding, all workplace characteristics are measured prior to birth. Therefore, workplace characteristics do not capture movement into jobs with characteristics that facilitate breastfeeding after birth. Measuring workplace characteristics before birth is consistent with when working women are likely to make decisions about breastfeeding and working (Riordan and Auerbach, 1998). One drawback of this strategy is that if women move into jobs with more workplace characteristics after birth than the effects of workplace characteristics may be underestimated.

It is still possible that workplace characteristics are endogenous as women may select jobs with characteristics facilitating breastfeeding prior to birth. However, studies (Avertt and Whittington, 2001; Dalto, 1989) have not found that women sort by fertility expectations into jobs based on their maternity leave policies. While fertility expectations are not the same as breastfeeding desires, I hypothesize that fertility desires are a primary consideration for women and breastfeeding desires are a secondary one. Therefore if one does not observe women sorting jobs based on fertility desires, it is likely that women do not select themselves into jobs based on breastfeeding decisions. Because maternity leave policies may differ from the workplace characteristics focused on in this paper as they are stipulated by FMLA, I perform several exercises to assess whether women select jobs with characteristics that promote breastfeeding prior to birth.[36]

The first exercise is similar to one performed by Avertt and Whittington (2001) and tests whether women with greater inherent fertility desires choose jobs with the four workplace characteristics of interest. If desired fertility influences the hours worked at home or the probability that a mother has a flexible schedule available, employer-sponsored child care available, or works a rotating schedule, the marginal effects of the fertility variables would be

[36] Another approach to address the potential endogeneity of the workplace characteristics is to instrument for each workplace characteristic. However, identifying valid instruments for all four workplace characteristics was not possible. Instruments considered and found to be weak include state breastfeeding laws regarding employment, state/federal maternity leave laws, state average firm size, percent of state employment in government jobs, percent of state employment in professional jobs, percent of state employment in retail jobs, and percent of state employment covered by unions. Another option to address the endogeneity of workplace characteristics is to estimate a fixed-effects model with the mother as the fixed effect. Such a strategy exploits the panel nature of the NLSY79 and the fact that some mothers have multiple children in the sample. However, such an estimation strategy requires the strong assumption that unobserved characteristics of the mother may affect choice of workplace and breastfeeding practices remain constant between children.

statistically significant and in the expected direction. While these measures of fertility expectations do not capture one's propensity to breastfeed, they provide evidence of whether a woman selects her job based on fertility desires. As mentioned earlier, one would hypothesize that a woman would choose a job based on fertility desires before considering her propensity to breastfeed. Therefore, if no evidence exists that women choose jobs by fertility desires, it is likely that women do not choose jobs based on breastfeeding desires.

I estimate ordinary least squares (OLS) models when the outcome of interest is hours worked at home and probit models when the dependent variable is availability of flexible schedules, availability of employer-sponsored child care, and work a rotating schedule. All models include the following explanatory variables: non-Hispanic Black, Hispanic, no college, some college, age, husband/partner present, family size, born in the United States, urban, reside in the Northeast, reside in the South, reside in the West, AFQT score, first birth, multiple birth, and year fixed effects. Five variables, measured in 1979, capture a woman's innate fertility desires. The first variable is the number of children considered ideal for a family. The second variable is the number of desired children. The third variable is whether one desires more children. The fourth variable is the number of siblings the mother has, which can be viewed as a proxy for fertility desires. The final variable captures the mother's views about gender roles.[37]

Table 6 presents the results of this exercise. Of the 20 coefficients of interest, only one is statistically significant. When work a rotating schedule is the outcome of interest, the coefficient on the number of children considered ideal is statistically significant. Overall, the results from this exercise indicate that women are not choosing jobs based on early fertility desires. While this exercise suggests that women do not select jobs based on inherent fertility desires, fertility desires may change over time and therefore no correlation between workplace characteristics prior to birth and earlier fertility desires is detected.

If fertility desires and possibly even breastfeeding desires change as one gets older and women change jobs to accommodate these desires, we would expect to see women changing jobs into those with more appealing workplace characteristics prior to birth. Figure 2 illustrates that among mothers having their first births, approximately one-third of them moved into their current jobs two to three years before giving birth. To test whether women are systematically

[37] The question asks if a female respondent strongly disagrees, disagrees, agrees, or strongly agrees with the following statement, "It is much better for everyone concerned if the man is the achiever outside the home and the woman takes care of the home and family."

selecting jobs prior to giving birth based on their workplace characteristics, I regress years at job before birth on each workplace characteristic. The expected sign of years on job before birth is unclear as women may select jobs with workplace characteristics that facilitate breastfeeding when they enter the job market or shortly before they give birth. For example, if women who desire to breastfeed choose jobs that allow them to breastfeed upon entrance into the job market, we would expect the sign to be positive and significant. In contrast, if women move into jobs shortly before birth that would allow them to breastfeed then we would expect coefficient on each workplace characteristic to be negative and significant.

To perform this exercise the analysis sample is restricted to first births because, presumably, women who have already borne children have already adjusted their behavior to accommodate breastfeeding and other maternal activities. Otherwise the models are the same as those estimated in the previous exercise. Table 7 presents the results of the variables of interest from this exercise. None of the coefficients on years on job before birth are statistically significant and their magnitudes are essentially zero suggesting that women are not systematically choosing jobs with workplace characteristics favorable for breastfeeding. I also test whether starting the job two to three years before birth is a strong predictor of possessing one of these characteristics and it is not. One explanation for why there is no effect of years on job before birth on workplace characteristics is that women change to jobs more favorable for breastfeeding at varying points in time before birth.

To further explore whether women are selecting jobs with favorable characteristics, but at any time prior to birth, I test whether having a planned birth is a strong predictor of working at a job with one of these four workplace characteristics. Presumably if a birth is unplanned the expecting mother does not have much time to change jobs, approximately eight months at most. If women with planned pregnancies are selecting jobs with favorable characteristics, we would expect to see a significant effect in the expected direction of the planned pregnancy indicator on each workplace characteristic.

I estimate the same model as used in the years on job before birth exercise substituting planned pregnancy for years on job before birth.[38] Table 7 shows the results for the exercise.

[38] Several variables in the NLSY79 could be used to determine whether the pregnancy was planned. One sequence of questions asks whether any contraception methods were used to prevent the pregnancy prior to conception. If no methods were used, the respondent is asked if this was because she wanted to become pregnant. The final question in the sequence asks the respondent if she wanted to become pregnant. The respondent can answer: "yes," "didn't

Planned pregnancy is only significant in the child care available model. However the coefficient is negative, the opposite of what was expected. One possible explanation for this is that women with a planned birth are more likely select their jobs on other characteristics more important to them such as availability health insurance, dental insurance, or maternity leave. Statistics indicate that this is the case with women with planned births more likely to have health and dental insurance available than those whose births were not planned. Therefore it appears that women select jobs with certain characteristics; however, they are not choosing jobs with those characteristics that facilitate breastfeeding.

In summary, while there are few exceptions, the bulk of the estimates from these exercises suggest that workplace characteristics are not likely to be endogenous to breastfeeding.

7. CONCLUSION

This paper seeks to understand the role of one potential mechanism that may affect breastfeeding practices among working women: workplace characteristics. Specifically, the effect of hours worked at home, availability of flexible schedules, availability of employer-sponsored child care, and working a rotating schedule on three breastfeeding outcomes is estimated using the National Longitudinal Survey of Youth 1979. Estimates from recursive bivariate probit models indicate that working an additional eight at hours at home per week compared to working no hours at home increases the probability of breastfeeding by approximately 9 and 21 percent at birth and six months after birth, respectively. The availability of employer-sponsored child care increases the likelihood of breastfeeding six months after birth by approximately 59 percent. Working a rotating schedule and the availability of a flexible schedule do not have significant effects on breastfeeding outcomes.

To understand the implications of these findings, the possibility that workplace characteristics may be endogenous to breastfeeding is explored. If women who wish to breastfeed select jobs that possess characteristics that facilitate breastfeeding and working, the marginal effects of workplace characteristics would be overestimated. This paper investigates women's job choices in relation to fertility and finds little evidence suggesting that workplace

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matter," "no—not right now," and "no—no more kids at all." I code those births that were not using contraception with the intent to conceive and wanted the child as a planned birth and all other births as unplanned births.

characteristics are endogenous to breastfeeding.

How large are these effects?

While more research will clarify the effects of workplace characteristics on breastfeeding, placing the estimated effect sizes in context of findings from other interventions signals the importance of additional research on this topic. Different types of outreach including phone calls and home visits from health professionals, informational packages, and medical office visits have had mixed success increasing breastfeeding rates. Table 8 shows the effect sizes from nine randomized control trials (RCTs) conducted in the United States since 1990 with the objective of influencing breastfeeding rates up to six months after birth. While the effect sizes of some of these interventions are large, only five of the eighteen effects are statistically significant at conventional levels. The range of effect sizes of those that are statistically significant is 31 to 311 percent with a median of 78 percent. While the workplace characteristic estimates are not directly comparable to those from other studies because of different objectives and study populations, the effect sizes of workplace characteristics fall in the low to middle portion of this range. Given that the success of currently used interventions is mixed and the effect sizes of workplace characteristics are comparable to those from successful interventions, workplace characteristics show promise of being an effective way of increasing breastfeeding rates.

If additional research illustrates that workplace characteristics are effective in increasing breastfeeding rates, policies to increase the percentage of women with these workplace characteristics may be worth pursuing. Employers would need to offer such options and would want to benefit from providing them. Findings from this study illustrate that the four workplace characteristics studied are not associated with increased retention rates or earlier return to work. However, Cohen, Mrtek, and Mrtek (1995) suggest offering workplace characteristics facilitating breastfeeding is associated with reduced maternal absenteeism.

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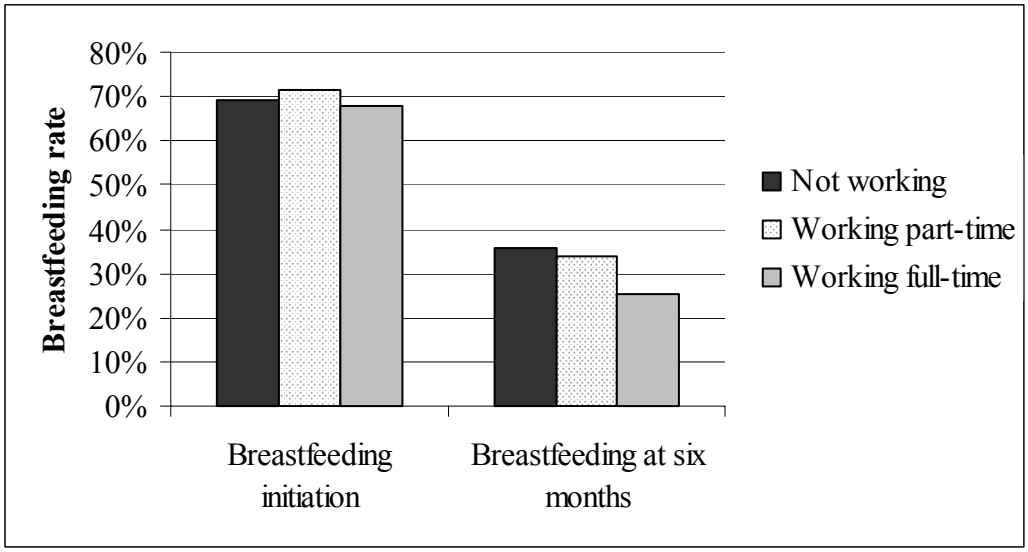
FIGURES AND TABLES

Figure 1. Breastfeeding at Initiation and Six Month by Work Status, 2001



Source: Ryan, 2002
Notes: The following statistics are from the Ross Laboratories Mothers Survey (RLMS). In this survey, employment status is measured concurrently with breastfeeding behavior six months after birth. Employment status is measured one month after birth for comparison with breastfeeding initiation (i.e., in the hospital) rates

Figure 2. Distribution of Years Before First Birth Mothers Made Most Recent Job Change

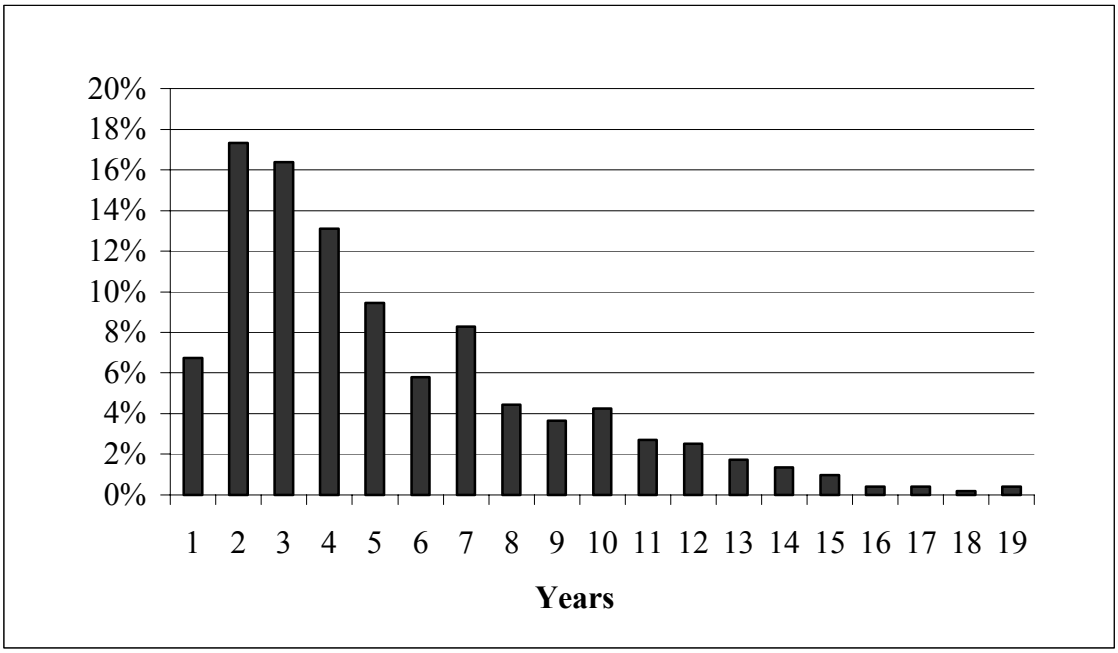


Table 1. Characteristics of Analysis Sample

	Mean	Standard deviation
Breastfeeding outcomes		
Initiate breastfeeding	0.596	0.491
Breastfeed to 6 months	0.195	0.396
Workplace characteristics		
Hours work at home	1.48	5.79
Flexible schedule available	0.524	0.500
Child care available	0.103	0.303
Work rotating schedule	0.085	0.279
Work status		
Return to work within 3 months	0.731	0.443
Return to work within 6 months	0.874	0.331
Maternal characteristics		
Age	31.40	3.34
Non-Hispanic White	0.567	0.496
Non-Hispanic Black	0.238	0.426
Hispanic	0.195	0.396
Born in the US	0.929	0.257
Education	13.73	2.47
AFQT score	45.51	27.42
Smoke	0.192	0.394
Receive any public assistance	0.299	0.458
Family size	3.992	1.218
Husband/partner present	0.829	0.376
Birth characteristics		
Low birth-weight	0.084	0.277
C-section performed	0.249	0.433
First birth	0.356	0.479
Multiple birth	0.037	0.189
Contextual variables		
Reside in the Northeast	0.173	0.379
Reside in the South	0.397	0.489
Reside in the West	0.188	0.391
Reside in the Midwest	0.242	0.428
Public breastfeeding law	0.206	0.405
Employment breastfeeding law	0.072	0.259
State food tax rate	0.015	0.023
Year fixed effects	1993.13	2.95
Instruments		
Employer-sponsored health insurance	0.787	0.410
Employer-sponsored dental insurance	0.644	0.479

Note: The sample size is 1,482.

Table 2a. Return to Work by Availability of Employer-sponsored Health and Dental Insurance

	Return to work within 3 months	Return to work within 6 months
Employer-sponsored health insurance:		
Available	0.758	0.910
Unavailable	0.633	0.744
P-value of difference between means	0.000*	0.000*
Employer-sponsored dental insurance:		
Available	0.756	0.920
Unavailable	0.687	0.791
P-value of difference between means	0.004*	0.000*

Note: The sample size is 1,482.
* Difference between means is statistically significant at the 5 percent level using a two-tailed test.

Table 2b. Breastfeeding by Availability of Employer-sponsored Health and Dental Insurance

	Breastfeeding initiation	Breastfeeding at 6 months	Duration of breastfeeding in weeks	Duration of breastfeeding in weeks (if initiate)
Employer-sponsored health insurance:				
Available	0.597	0.184	11.80	19.77
Unavailable	0.592	0.237	13.46	22.75
P-value of difference between means	0.869	0.032*	0.174	0.090
Employer-sponsored dental insurance:				
Available	0.620	0.186	12.12	19.55
Unavailable	0.552	0.211	12.22	22.12
P-value of difference between means	0.011*	0.260	0.926	0.093

Note: The sample size is 1,482.
* Difference between means is statistically significant at the 5 percent level using a two-tailed test.

Table 3. Mean of Selected Variables by Workplace Characteristic Status

	Work any hours at home?		Flexible schedule available?		Child care available?		Work a rotating schedule?	
	Yes	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*
Breastfeeding outcomes								
Initiate breastfeeding	0.751*	0.567	0.606	0.585	0.664	0.588	0.635	0.592
Breastfeed to 6 months	0.305*	0.175	0.184	0.207	0.303*	0.183	0.206	0.194
Workplace characteristics								
Work any hours at home	-	-	0.144	0.171	0.145	0.159	0.214	0.152
Flexible schedule available	0.481	0.532	-	-	0.789*	0.493	0.738*	0.504
Child care available	0.094	0.104	0.155*	0.045	-	-	0.095	0.103
Work rotating schedule	0.116	0.079	0.120*	0.047	0.079	0.086	-	-
Work status								
Return to work within 3 months	0.790*	0.721	0.724	0.739	0.697	0.735	0.690	0.735
Return to work within 6 months	0.910	0.868	0.880	0.868	0.901	0.871	0.841	0.878
Maternal characteristics								
Age	32.00*	31.29	31.54	31.25	31.88	31.35	31.96	31.35
Non-Hispanic White	0.700*	0.543	0.566	0.569	0.533	0.571	0.635	0.561
Non-Hispanic Black	0.155*	0.253	0.242	0.232	0.243	0.237	0.190	0.242
Hispanic	0.146*	0.204	0.192	0.198	0.224	0.192	0.175	0.197
Born in the US	0.936	0.928	0.930	0.928	0.875*	0.935	0.960	0.926
Education	15.61*	13.38	13.75	13.71	14.26*	13.67	13.76	13.73
AFQT score	61.19*	42.59	45.00	46.08	46.42	45.41	44.61	45.60
Receive any public assistance	0.220*	0.313	0.300	0.297	0.289	0.300	0.286	0.300
Birth characteristics								
C-section performed	0.202	0.258	0.254	0.244	0.237	0.250	0.238	0.250
First birth	0.361	0.355	0.344	0.368	0.296	0.362	0.317	0.359
Contextual variables								
Reside in the Northeast	0.155	0.177	0.182	0.164	0.164	0.174	0.183	0.173
Reside in the South	0.438	0.389	0.352*	0.446	0.349	0.402	0.349	0.401
Reside in the West	0.197	0.187	0.211*	0.163	0.217	0.185	0.183	0.189
Reside in the Midwest	0.210	0.247	0.255	0.227	0.270	0.238	0.286	0.237
Public breastfeeding law	0.206	0.207	0.219	0.193	0.270*	0.199	0.238	0.204
Employment breastfeeding law	0.077	0.071	0.070	0.075	0.092	0.070	0.063	0.073
Year fixed effects	1993.56*	1993.06	1993.25	1993.01	1993.76*	1993.06	1993.86*	1993.07
Job characteristics								
Government organization	0.410	0.444	0.436	0.440	0.500	0.431	0.550*	0.428
Private organization	0.438	0.480	0.464	0.483	0.386	0.484	0.303*	0.489
Self-employed	0.095*	0.058	0.075	0.051	0.100	0.060	0.073	0.063
Professional job	0.546*	0.239	0.269	0.308	0.353	0.280	0.254	0.291
Clerical job	0.127*	0.361	0.335	0.311	0.333	0.322	0.195*	0.335

Note: The sample size is 1,482.

* Difference between means is statistically significant at the 5 percent level using a two-tailed test.

Table 4. Bivariate Probit Results for Breastfeeding Initiation and Return to Work Within 3 Months

	Breastfeeding initiation			Return to work within 3 months		
	Coefficient	*Standard error*[a]	*Marginal effect*[b]	*Coefficient*	*Standard error*[a]	*Marginal effect*[b]
Workplace characteristics, work status, and instruments						
Hours work at home	0.018	0.008	0.007*	0.023	0.009	0.007**
Flexible schedule available	0.050	0.076	0.019	-0.021	0.080	-0.007
Child care available	0.046	0.155	0.017	-0.208	0.117	-0.070
Work rotating schedule	0.012	0.157	0.005	-0.170	0.136	-0.056
Return to work within 3 months	-0.745	1.065	-0.263	-	-	-
Employer-sponsored health insurance	-	-	-	0.367	0.117	0.124**
Employer-sponsored dental insurance	-	-	-	0.074	0.120	0.023
Maternal characteristics						
Age	-0.014	0.020	-0.005	-0.020	0.019	-0.006
Non-Hispanic Black	-0.187	0.127	-0.073	0.006	0.121	0.002
Hispanic	0.206	0.121	0.077	0.113	0.121	0.035
Born in the US	-0.278	0.184	-0.102	-0.278	0.161	-0.080
No college	-0.281	0.120	-0.108*	-0.125	0.115	-0.040
Some college	-0.206	0.114	-0.080	-0.077	0.109	-0.025
AFQT score	0.013	0.002	0.005**	0.002	0.002	0.001
Smoke	-0.298	0.107	-0.116**	0.029	0.107	0.009
Receive any public assistance	-0.096	0.113	-0.037	-0.146	0.096	-0.047
Family size	-0.032	0.047	-0.012	-0.079	0.038	-0.025*
Husband/partner present	0.180	0.117	0.070	-0.047	0.114	-0.015
Birth characteristics						
Low birth-weight	-0.373	0.150	-0.147*	-0.011	0.144	-0.004
C-section performed	-0.169	0.091	-0.065	-0.044	0.091	-0.014
First birth	0.045	0.131	0.017	-0.229	0.105	-0.074*
Multiple birth	-0.323	0.396	-0.127	-0.725	0.269	-0.268**
Contextual variables						
Reside in the Northeast	-0.152	0.203	-0.059	-0.456	0.120	-0.157**
Reside in the South	-0.121	0.120	-0.047	0.145	0.108	0.045
Reside in the West	0.412	0.199	0.150*	-0.206	0.127	-0.068
Public breastfeeding law	-0.137	0.126	-0.053	-0.012	0.120	-0.004
Employment breastfeeding law	0.650	0.238	0.219**	-0.185	0.194	-0.061
State food tax rate	2.203	3.187	0.845	-6.016	1.861	-1.906**
Mean of the dependent variable		0.596			0.731	
ρ (standard error): 0.359 (0.663)		Wald test of $\rho = 0$: chi2(1)= 0.243, $p = 0.622$				

Notes: The sample size is 1,482. Omitted categories are the following: Non-Hispanic White, college graduate, and reside in the Midwest. All models also include year fixed effects and dummy variables for missing values for smoke, low birth-weight, and c-section performed.

a. Standard errors are adjusted.

b. The marginal effects are evaluated at the means of the independent variables.

* significant at 5 percent level; ** significant at 1 percent level

Table 5. Bivariate Probit Results for Breastfeeding at 6 Months and Return to Work Within 6 Months

	Breastfeeding at six months			Return to work within 6 months		
	Coefficient	*Standard error*[a]	*Marginal effect*[b]	*Coefficient*	*Standard error*[a]	*Marginal effect*[b]
Workplace characteristics, work status, and instruments						
Hours work at home	0.019	0.007	0.005**	0.007	0.007	0.001
Flexible schedule available	-0.120	0.085	-0.030	0.036	0.096	0.006
Child care available	0.395	0.141	0.114**	-0.087	0.158	-0.015
Work rotating schedule	-0.064	0.148	-0.016	-0.280	0.168	-0.054
Return to work within 6 months	-1.167	0.558	-0.390*	-	-	-
Employer-sponsored health insurance	-	-	-	0.402	0.125	0.077**
Employer-sponsored dental insurance	-	-	-	0.296	0.115	0.052**
Maternal characteristics						
Age	-0.002	0.022	-0.001	0.009	0.024	0.002
Non-Hispanic Black	-0.282	0.146	-0.066	-0.041	0.155	-0.007
Hispanic	-0.037	0.135	-0.009	0.134	0.154	0.021
Born in the US	-0.107	0.175	-0.028	-0.469	0.211	-0.059*
No college	-0.234	0.128	-0.058	-0.246	0.144	-0.042
Some college	-0.079	0.120	-0.020	-0.063	0.150	-0.011
AFQT score	0.009	0.002	0.002**	0.002	0.002	0.000
Smoke	-0.354	0.122	-0.080**	0.009	0.113	0.002
Receive any public assistance	-0.097	0.114	-0.024	-0.321	0.116	-0.058**
Family size	-0.016	0.051	-0.004	-0.054	0.043	-0.009
Husband/partner present	-0.012	0.140	-0.003	0.081	0.136	0.014
Birth characteristics						
Low birth-weight	-0.414	0.180	-0.087*	-0.130	0.155	-0.023
C-section performed	-0.075	0.102	-0.018	0.131	0.113	0.021
First birth	0.090	0.100	0.023	-0.053	0.109	-0.009
Multiple birth	-0.619	0.350	-0.115	-0.654	0.282	-0.155*
Contextual variables						
Reside in the Northeast	0.013	0.149	0.003	-0.364	0.158	-0.070*
Reside in the South	-0.003	0.127	-0.001	0.245	0.140	0.039
Reside in the West	0.340	0.143	0.094*	-0.258	0.149	-0.048
Public breastfeeding law	0.201	0.139	0.053	0.158	0.177	0.025
Employment breastfeeding law	-0.262	0.224	-0.059	-0.563	0.269	-0.125*
State food tax rate	4.328	2.334	1.091	-6.882	2.330	-1.143**
Mean of the dependent variable		0.195			0.874	
ρ (standard error): 0.405 (0.284)		Wald test of $\rho = 0$: chi2(1)= 1.599, $p = 0.206$				

Notes: The sample size is 1,482. Omitted categories are the following: Non-Hispanic White, college graduate, and reside in the Midwest. All models also include year fixed effects and dummy variables for missing values for smoke, low birth-weight, and c-section performed.

a. Standard errors are adjusted.

b. The marginal effects are evaluated at the means of the independent variables.

* significant at 5 percent level; ** significant at 1 percent level

Table 6. Do Fertility Desires Predict Possession of Workplace Characteristics?

	Hours work at home[a]	Flexible schedule available[b]	Child care available[b]	Work rotating schedule[b]
Number of children considered ideal	0.022	-0.013	-0.002	-0.015*
Standard error	(0.179)	(0.012)	(0.007)	(0.006)
Sample size	1,477	1,477	1,477	1,477
R-squared	0.053	0.078	0.045	0.080
Number of children desired	0.055	-0.004	0.001	-0.005
Standard error	(0.146)	(0.01)	(0.005)	(0.005)
Sample size	1,476	1,476	1,476	1,476
R-squared	0.053	0.093	0.046	0.072
Desire more children	0.081	0.003	-0.005	-0.006
Standard error	(0.118)	(0.010)	(0.006)	(0.005)
Sample size	1,466	1,466	1,466	1,466
R-squared	0.054	0.020	0.047	0.073
View oneself as a homemaker	0.102	-0.015	-0.008	0.014
Standard error	(0.247)	(0.019)	(0.011)	(0.008)
Sample size	1,475	1,475	1,475	1,475
R-squared	0.053	0.020	0.047	0.074
Number of siblings	-0.035	-0.010	-0.006	0.001
Standard error	(0.052)	(0.006)	(0.004)	(0.003)
Sample size	1,481	1,481	1,481	1,481
R-squared	0.053	0.021	0.050	0.071
Mean of the dependent variable	1.72	0.550	0.096	0.098

Notes: Adjusted standard errors of the marginal effects are in parentheses. All models also include the following variables: Non-Hispanic Black, Hispanic, high school, some college, age, husband/partner present, family size, born in the US, urban, reside in the Northeast, reside in the South, reside in the West, AFQT score, first birth, multiple birth, and year fixed effects.

a. Coefficients from OLS models.

b. Marginal effects from probit models are evaluated at the means of the independent variables.

* significant at 5 percent level; ** significant at 1 percent level

Table 7. Do Women Select Jobs with Workplace Characteristics Facilitating Breastfeeding before Birth?

	Hours work at home[a]	Flexible schedule available[b]	Child care available[b]	Work rotating schedule[b]
Years on job before birth	-0.009	0.007	0.000	0.000
Standard error	(0.052)	(0.007)	(0.003)	(0.002)
Sample size	520	520	520	520
R-squared	0.063	0.051	0.105	0.172
Planned birth	0.471	-0.040	-0.056**	-0.023
Standard error	(0.714)	(0.071)	(0.020)	(0.016)
Sample size	503	503	503	503
R-squared	0.064	0.055	0.085	0.174
Mean of the dependent variable	1.48	0.524	0.103	0.085

Notes: Adjusted standard errors of the marginal effects are in parentheses. All models also include the following variables: Non-Hispanic Black, Hispanic, high school, some college, age, husband/partner present, family size, born in the US, urban, reside in the Northeast, reside in the South, reside in the West, AFQT score, multiple birth, and year fixed effects.
a. Coefficients from OLS models.
b. Marginal effects from probit models are evaluated at the means of the independent variables.
* significant at 5 percent level; ** significant at 1 percent level

Table 8. Effect Sizes from US RCTs to Increase Breastfeeding

Author (year)	Services[a]	Outcome	Effect size[b]	Statistically significant?[c]
Brent et al. (1995)	Daily round at hospital, phone calls, individual consultations up to 1 year	Initiate any breastfeeding	0.91	Yes
		Any breastfeeding at 2 months	3.11	Yes
		Any breastfeeding at 6 months	2.00	No
Escobar et al. (2001)[d]	Home visit	Any breastfeeding at 2 weeks	-0.17	No
Grossman et al. (1990)	Individual session, informational booklet, phone calls, lactation clinic available	Any breastfeeding at 6 weeks	-0.24	No
		Any breastfeeding at 3 months	-0.37	No
		Any Breastfeeding at 6 months	-0.64	No
Kistin et al. (1990)	Prenatal group sessions	Initiate any breastfeeding	0.31	Yes
	Prenatal individual sessions	Initiate any breastfeeding	0.38	Yes
Lieu et al. (2000)[e]	Home visit	Any breastfeeding at 2 weeks	-0.05	No
Pugh and Milligan (1998)	Home visits and phone calls	Any Breastfeeding at 6 months	0.85	No
Pugh et al. (2002)	Postnatal hospital visits, home visits, counselors available by phone	Exclusive breastfeeding at 3 months	0.63	No
		Exclusive breastfeeding at 6 months	1.00	No
Serafino-Cross and Donovan (1992)	Home visits and counselor available	Initiate any breastfeeding	0.04	No
		Any breastfeeding at 2 months	0.78	Yes
Serwint et al. (1996)	One prenatal pediatric visit	Initiate any breastfeeding	0.35	No
		Any breastfeeding at 1 month	0.36	No
		Any breastfeeding at 2 months	0.22	No

a. Unless noted the control group received the usual care.
b. Effect size is the difference in breastfeeding rates between the control and intervention groups divided by the breastfeeding rate for the control group.
c. Effect size is statistically significant at the 5 percent level using a two-tailed test.
d. In this study, usual care is includes group visits, one-on-one clinic visits, and breastfeeding consultation.
e. In this study, usual care is a pediatric clinic visit.

Table A1. Definitions and Timing of Variables

Variable	Definition and timing
Breastfeeding outcomes	
Initiate breastfeeding	Breastfeed for one week or longer after birth
Breastfeed to 6 months	Breastfeed for 6 months (24 weeks) or longer after birth
Workplace characteristics	
Hours work at home	Hours per week usually worked at home prior to birth
Flexible schedule available	Flexible work schedule or hours available prior to birth
Child care available	Employer-sponsored child care available prior to birth
Work rotating schedule	Shift rotates, work irregular hours, or other compared to working fixed day shift, night shift, evening shift or spilt shift prior to birth
Work status	
Return to work within 3 months	Mother returned to work within 3 months (12 weeks) after birth
Return to work within 6 months	Mother returned to work within 6 months (24 weeks) after birth
Maternal characteristics	
Age	Age at birth of child
Non-Hispanic White	Non-Hispanic, Non-Black
Non-Hispanic Black	Non-Hispanic Black
Hispanic	Hispanic
Born in the US	Country of birth is United States
No college	Highest grade completed is 12th grade or less at the first survey after birth
Some college	Highest grade completed is 13-15 years at the first survey after birth
College graduate	Highest grade completed is 16-20 years at the first survey after birth
AFQT score	Armed forces qualification test percentile score from 1979 and rescaled in 1989
Smoke	Smoked anytime during 12 months before birth
Receive any public assistance	Receive benefits from AFDC, Food Stamps, SSI, welfare, WIC, or other public assistance during the year of birth
Family size	Number of blood, marriage, and adopted household members at the first survey after birth
Husband/partner present	Husband or opposite sex partner present in household at the first survey after birth
Birth characteristics	
Low birth-weight	Birth weight of child 5.5 pounds or less
C-section performed	Child delivered by cesarean section
First birth	First birth
Multiple birth	Child part of a multiple birth
Contextual variables	
Reside in the Northeast	Reside in CT, MA, ME, NH, NJ, NY, PA RI, VT at the first survey after birth

Table A1. Definitions and Timing of Variables (continued)

Variable	Definition and timing
Reside in the South	Reside in AL, AR, DE, DC, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV at the first survey after birth
Reside in the West	Reside in AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA, WY at the first survey after birth
Reside in the Midwest	Reside in IL, IN, IA, KS, MI, MN, MO, NE, ND, OH, SD, WI at the first survey after birth
Public breastfeeding law	Breastfeeding public law in effect during the year of birth
Employment breastfeeding law	Breastfeeding employment law in effect during the year of birth
State food tax rate	State sales tax rate on food during the year of birth
Year fixed effects	Year dummy variables coded 1 for the year of birth
Instruments	
Employer-sponsored health insurance	Health insurance available from employer prior to the birth
Employer-sponsored dental insurance	Dental insurance available from employer prior to the birth
Additional variables	
Years on job before birth	Years worked for employer at birth
Government organization	Employed by a government agency prior to the birth
Private organization	Employed by a private organization prior to the birth
Self-employed	Work for oneself prior to the birth
Professional job	Job classification is professional prior to the birth
Clerical job	Job classification is clerical prior to the birth
Planned pregnancy	Birth was planned
Number of children considered ideal	Number of children considered ideal by mother in 1979
Number of children desired	Number of children desired by mother in 1979
View oneself as a homemaker	Mother views herself as a homemaker in 1979
Number of siblings	Number of siblings of the mother in 1979
Urban	Reside in an urban area at the first survey after birth

Table A2. Description of State Breastfeeding Laws and Sales Tax Rates

State	Year public breastfeeding law enacted	Year employment breastfeeding law enacted	1999 sales tax rate on food	Previous state sales tax rates on food
Alabama	-	-	4.00%	
Alaska	1998	-	0.00%	
Arizona	-	-	0.00%	
Arkansas	-	-	4.63%	1988-1991: 4.00%; 1992-1997: 4.50%
California	1997	1998	0.00%	
Colorado	-	-	3.00%	
Connecticut	1997	-	0.00%	
Delaware	1997	-	0.00%	
District of Columbia	-	-	0.00%	
Florida	1993	1994	0.00%	
Georgia	1999	1999	4.00%	1988-1989: 3.00%
Hawaii	1999	1999	4.00%	
Idaho	-	-	5.00%	
Illinois	1995	-	6.25%	1988-1989: 5.00%
Indiana	-	-	0.00%	
Iowa	1999	-	0.00%	
Kansas	-	-	4.90%	1988-1989: 4.00%; 1990-1992: 4.25%
Kentucky	-	-	0.00%	
Louisiana	-	-	0.00%	
Maine	1999	-	0.00%	
Maryland	-	-	0.00%	
Massachusetts	-	-	0.00%	
Michigan	1994	-	0.00%	
Minnesota	1997	1997	0.00%	
Mississippi	-	-	7.00%	1988-1992: 6.00%
Missouri	1999	-	4.23%	
Montana	1999	-	0.00%	
Nebraska	-	-	5.00%	1988-1991: 4.00%
Nevada	1995	-	0.00%	
New Hampshire	1999	-	0.00%	
New Jersey	1997	-	0.00%	
New Mexico	1999	-	5.00%	1988-1990: 4.75%
New York	1984	-	0.00%	
North Carolina	1993	-	4.00%	1988-1991: 3.00%
North Dakota	-	-	0.00%	
Ohio	-	-	0.00%	

Table A2. Description of State Breastfeeding Laws and Sales Tax Rates (continued)

State	Year public breastfeeding law enacted	Year employment breastfeeding law enacted	1999 sales tax rate on food	Previous state sales tax rates on food
Oklahoma	-	-	4.50%	1988-1990: 4.00%
Oregon	1999	-	0.00%	
Pennsylvania	-	-	0.00%	
Rhode Island	1998	-	0.00%	
South Carolina	-	-	5.00%	
South Dakota	-	-	4.00%	
Tennessee	-	1999	6.00%	1988-1992: 5.50%
Texas	1995	1995	0.00%	
Utah	1995	-	4.75%	1988-1989: 5.09%; 1990-1994: 5.00%; 1995-1997: 4.88%
Vermont	-	-	0.00%	
Virginia	1994	-	3.50%	
Washington	-	-	6.50%	
West Virginia	-	-	0.00%	
Wisconsin	1995	-	0.00%	
Wyoming	-	-	4.00%	1988-1993: 3.00%

Sources: State breastfeeding law information is from La Leche League International (2001) and data on state tax rates on food are from the World Tax Database.

Table A3. Marginal Effects from Probit Models for Breastfeeding and Work Outcomes

	Breastfeeding initiation		Breastfeeding at 6 months	
	Marginal effect[a]	***Standard error[b]***	***Marginal effect[a]***	***Standard error[b]***
Workplace characteristics and work status				
Hours work at home	0.006*	(0.003)	0.005**	(0.002)
Flexible schedule available	0.019	(0.030)	-0.033	(0.022)
Child care available	0.032	(0.050)	0.115*	(0.046)
Work rotating schedule	0.021	(0.052)	-0.007	(0.036)
Return to work	-0.060	(0.032)	-0.123**	(0.039)
Maternal characteristics				
Age	-0.004	(0.007)	-0.001	(0.006)
Non-Hispanic Black	-0.078	(0.048)	-0.067*	(0.031)
Hispanic	0.073	(0.045)	-0.011	(0.033)
Born in the US	-0.088	(0.060)	-0.017	(0.045)
No college	-0.100*	(0.047)	-0.051	(0.031)
Some college	-0.077	(0.045)	-0.020	(0.029)
AFQT score	0.005**	(0.001)	0.002**	(0.001)
Smoke	-0.119**	(0.040)	-0.077**	(0.024)
Receive any public assistance	-0.025	(0.038)	-0.010	(0.026)
Family size	-0.006	(0.014)	-0.001	(0.012)
Husband/partner present	0.073	(0.045)	-0.010	(0.035)
Birth characteristics				
Low birth-weight	-0.150**	(0.057)	-0.081**	(0.030)
C-section performed	-0.065	(0.036)	-0.021	(0.024)
First birth	0.035	(0.034)	0.024	(0.026)
Multiple birth	-0.074	(0.126)	-0.102*	(0.046)
Contextual variables				
Reside in the Northeast	-0.026	(0.051)	0.013	(0.039)
Reside in the South	-0.056	(0.042)	-0.006	(0.031)
Reside in the West	0.170**	(0.045)	0.105*	(0.043)
Public breastfeeding law	-0.055	(0.050)	0.051	(0.038)
Employment breastfeeding law	0.231**	(0.052)	-0.050	(0.045)
State food tax rate	1.305	(0.742)	1.311*	(0.559)
Mean of the dependent variable	0.596		0.195	
Pseudo R-squared	0.169		0.126	

Notes: The sample size is 1,482. Omitted categories are the following: Non-Hispanic White, college graduate, and reside in the Midwest. All models also include year fixed effects and dummy variables for missing values for smoke, low birth-weight, and c-section performed.

a. The marginal effects are evaluated at the means of the independent variables.

b. Standard errors are adjusted.

* significant at 5 percent level; ** significant at 1 percent level