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DISSERTATION

# An Investigation of the Factors Influencing Breastfeeding Patterns

ALISON JACKNOWITZ

This document was submitted as a dissertation in May 2004 in partial fulfillment of the requirements of the doctoral degree in policy analysis at the Pardee RAND Graduate School. The faculty committee that supervised and approved the dissertation consisted of Steven J. Haider (Co-Chair), M. Rebecca Kilburn (Co-Chair), Julie DaVanzo, and Robert F. Schoeni.


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## EXECUTIVE SUMMARY

This document briefly summarizes the dissertation, "An Investigation of the Factors Influencing Breastfeeding Patterns," by Alison Jacknowitz.

### *Background and Motivation*

There are well-established short- and long-term benefits of breastfeeding to mothers and children. Research has shown that breastfeeding is associated with health, cognitive, and educational benefits for children. For example, studies in the United States (U.S.) 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 enterocoloitis. In addition to the physiological health benefits, human milk may benefit children's cognitive development. Studies also suggest that breastfeeding is beneficial for the mother's health. 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 state, and reduced menstrual blood loss. Some evidence also demonstrates an improved sense of maternal self-esteem, bonding with infant, and success with mothering.

Both individuals and society accrue large benefits from breastfeeding. For example, one study finds that medical expenditures were 20 percent less for fully-breastfed infants compared to never-breastfed infants (Hoey and Ware 1997). In addition, an analysis by the U.S. Department of Agriculture's Economic Research Service estimates at least $3.6 billion in annual savings if the prevalence of exclusive breastfeeding was increased to those levels recommended by the Surgeon General (Weimer 2001). This figure reflects $3.1 billion in savings attributable to preventing premature deaths and $0.5 billion in savings associated with reduced medical

expenses and indirect costs of time and earnings savings to parents. These estimates should be considered conservative as they only include the costs of three common infant illnesses. They do not include any health benefits to mothers or longer-term health benefits to children.

Reflecting research that indicates that both children and mothers benefit from breastfeeding, numerous individuals and organizations support and recommend breastfeeding. These individuals and organizations include the Surgeon General, American Pediatrics Association, American Medical Association, American Dietetic Association, American Academy of Family Physicians, and the World Health Organization. The 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" (U.S. DHHS 2000). The U.S. government has selected increasing breastfeeding rates as a *Healthy People 2010* objective alongside other national health goals such as decreasing rates of cancer, sexually transmitted diseases, obesity, and food insecurity. In addition, 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. Although researchers, public health organizations, and physicians generally agree on the importance of breastfeeding, a sizable percentage of the population does not breastfeed.

While a share of women does not breastfeed (29.9 percent in the hospital and 66.8 percent six months after birth in 2002), the likelihood of breastfeeding has oscillated over time and has varied by maternal characteristics. Between the early 1970s and 1982, there was an upward trend in breastfeeding rates. However, national breastfeeding rates exhibited a steady decline between 1983 and 1990. In 1991, breastfeeding rates, both for initiation and six months

after birth, began to increase again. Between 1991 and 2002 breastfeeding rates for all mothers increased 16.8 percentage points (31.5 percent) at birth and 15.0 percentage points (82.4 percent) six months after birth (Ryan 2002). Further, mothers across all demographic characteristics experienced increases in breastfeeding rates.

Disparities in breastfeeding rates exist, with low-income, Black, less-educated, younger, and working women being less likely to breastfeed. For example, the difference in breastfeeding rates between working and non-working mothers is large. In 2002, 27.1 percent of mothers working full-time breastfed six months after birth compared to 35.2 percent of non-working mothers (Ryan 2002). Given the short- and long-term health benefits of breastfeeding to mothers and children, relatively low rates of breastfeeding among disadvantaged groups may contribute to well-established health disparities at all stages of the life cycle.

While these breastfeeding patterns are well-documented, the explanations for them are not. Because of the potential benefits of breastfeeding to approximately four million infants and mothers in the U.S. each year, this dissertation investigates three explanations of breastfeeding patterns identified in the literature that have not been previously tested empirically. This dissertation contributes to this important policy problem by investigating whether the following factors influenced breastfeeding over the last decade 1) demographic changes; 2) welfare work requirements; and 3) workplace characteristics.

***Demographic Changes***

The dissertation first examines whether increases in breastfeeding rates since 1991 can be attributed to demographic changes. To answer the research question this study decomposes breastfeeding trends using 1991 through 2002 data from the Ross Laboratories Mothers Survey (RLMS) and birth certificate data. This analysis suggests that changes in the composition of

births by the following comprehensive set of demographic characteristics explain approximately 20 percent of the upward trend in initiation and duration breastfeeding rates during the 1990s: maternal age, maternal education, race/ethnicity, birth order, and geographic location of birth. The changes in birth composition by maternal age and education are the most important of these factors, explaining 9.8 and 11.5 percent of the increase in breastfeeding initiation rates, respectively. Similar results are observed for breastfeeding rates six months after birth, with birth composition changes by maternal age and education explaining 10.2 and 9.0 percent of increasing breastfeeding rates, respectively. While the results do explain approximately 20 percent of the upward trend in breastfeeding rates, they also underscore the importance of exploring the effects of other factors on breastfeeding rates.

***Welfare Work Requirements***

The third chapter examines whether the work requirements adopted as part of welfare reform have affected the prevalence of breastfeeding. A central theme of the recent welfare reform is the requirement that welfare recipients engage in work-related activities. In many states this requirement applies to mothers whose children are just a few months old. Holding a job increases the costs of breastfeeding, which in turn could reduce the propensity of new mothers to breastfeed their children. Both the descriptive statistics described earlier and multivariate studies illustrate that working negatively affects breastfeeding. Therefore, it is important to understand how these welfare work requirements affect breastfeeding rates. The analyses of data from the RLMS, presented in Chapter 3, suggest that if welfare reform had not been adopted, national breastfeeding rates six months after birth would be 5.5 percent higher.

***Workplace Characteristics***

Chapter 4 of the dissertation seeks to understand the role of workplace characteristics in the breastfeeding practices of working women. Working women are an important group to study because they comprise a large portion of new mothers, with over half (50.4 percent) of mothers with infants under 12 months of age working in 2002 (BLS 2003). As mentioned earlier, working women are also less likely to breastfeed than their non-working counterparts. The effects of availability of employer-sponsored child care, availability of a flexible schedule, hours worked at home, and working a rotating schedule on breastfeeding outcomes are estimated using the National Longitudinal Survey of Youth 1979 (NLSY79). The availability of employer-sponsored child care increases the likelihood of breastfeeding six months after birth by 59 percent. In addition, working an additional eight hours at home per week increases the probability of breastfeeding by approximately 9 and 21 percent at birth and six months after birth, respectively.

***Policy Implications and Future Research***

Three important lessons emerge from this dissertation. The first lesson is generated by exploring the rise in breastfeeding rates that began in 1991. Findings from this dissertation suggest that approximately 20 percent of the upward trend in breastfeeding rates is explained by well-known demographic changes. In contrast, findings suggest that welfare work requirements negatively influence breastfeeding rates, indicating that welfare reform does not help explain breastfeeding increases. In fact, breastfeeding rates would have been higher in the absence of welfare reform.

This dissertation also finds that some workplace characteristics positively influence breastfeeding rates. Because of data limitations, it is not possible to empirically test whether

workplace characteristics explain the increase in breastfeeding rates. However, ample information is available to hypothesize that if workplace characteristics explain any of the increase in breastfeeding rates since 1991, it is a small portion. It is generally believed that the prevalence of family-friendly workplace characteristics increased over the last decade, which suggests that workplace characteristics might explain some of the upward trend in breastfeeding rates. However, a little over 50 percent of mothers with children age one and under work and an even smaller portion of these working mothers have workplace characteristics that facilitate breastfeeding available. These two factors suggest that workplace characteristics play a small role in the recent increases in breastfeeding rates. Finally, the passage of two types of state breastfeeding laws is explored in this dissertation. Analyses suggest that these laws had little impact on national breastfeeding rates, indicating that they do not explain increases in breastfeeding rates.

While a portion of the increase in breastfeeding rates are explained by demographic changes, this dissertation demonstrates that other factors play a larger role in influencing breastfeeding trends and we need to continue exploring other explanations for the increases. Factors that might explain increases in breastfeeding rates are technological innovation and increased information. Technological innovation includes more advanced and less expensive breast pumps. On the other hand, innovations in formula technology may also contribute to lower breastfeeding rates. Increased public information on breastfeeding might also explain rising breastfeeding rates. The increasing number of research studies illustrating the benefits of breastfeeding and public health informational campaigns promoting breastfeeding is well-documented. However, it is not known whether this rise in information on the benefits of breastfeeding has lead to the observed increases in breastfeeding since 1991.

The second lesson learned from this dissertation is that policies can have unintended consequences that counter the efforts of other policies and programs. Results from this dissertation suggest that welfare work policies imposed a significant unintended cost on infants and their mothers by reducing the prevalence of breastfeeding and contributing to health disparities between the poor and non-poor. Thus, while the primary intention of welfare work requirements is to increase self-sufficiency among impoverished mothers, the policy has negative unintended consequences on breastfeeding and health disparities, both public health problems that the federal government is actively trying to address. The government must weigh the cost of these welfare work requirements against the potential benefits associated with them. However, the vast majority of the harmful effects on breastfeeding would be eliminated if mothers of infants were not required to work full-time, a requirement that is currently in place in about half of all states. Policies to facilitate breastfeeding among working mothers should also be explored.

The final lesson learned is the importance of understanding the underlying reasons for behavioral patterns when developing policy. For example, it is well-documented that women who work are less likely to breastfeed than those who do not, but it is not understood why some working women breastfeed and others do not. To create effective policies to increase breastfeeding among working women, it is crucial to understand the underlying reasons for their differences in behavior. This dissertation demonstrates that both working from home and the availability of employer-sponsored child care are promising practices to increase breastfeeding rates among working women. However, for the most part, these are not the practices promoted by the state breastfeeding laws.

To further understand the role of workplace characteristics in breastfeeding, more information on workplace characteristics is necessary. Of the workplace characteristics offered

those most likely to affect breastfeeding include availability of a lactation room, an office with a door, employer policies regarding job-sharing, and the frequency and duration of breaks. Future data collection efforts on the topic should include questions on these workplace characteristics.

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## ABSTRACT

A growing body of research indicates that both mothers and children benefit from breastfeeding. Reflecting such research, public health officials and organizations promote the practice of breastfeeding. 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. Furthermore, some groups of mothers are more likely to breastfeed than others. This dissertation seeks to understand these breastfeeding patterns by investigating the following three factors: 1) demographic changes; 2) welfare work requirements; and 3) workplace characteristics.

This dissertation first examines whether increases in breastfeeding rates between 1991 and 2002 can be attributed to well-documented changes in birth composition. Results suggest that changes in the composition of births by maternal age, maternal education, race/ethnicity, parity, and geographic location of birth explain approximately 20 percent of the increasing trends in initial breastfeeding rates and breastfeeding rates six months after birth. This finding also underscores the importance of exploring the impact of other factors on breastfeeding outcomes.

The effects of welfare work requirements on breastfeeding are examined. Findings suggest that, in the absence of welfare reform, the national breastfeeding rate six months after birth would have been 5.5 percent higher in 2000. Such unintended negative consequences of these welfare work requirements must be weighed against potential benefits as states refine their welfare programs.

Finally, the role of the following four workplace characteristics in the breastfeeding practices of working women is investigated: employer-sponsored child care, availability of a flexible schedule, hours worked at home, and working a rotating schedule. The availability of

employer-sponsored child care increases the likelihood of breastfeeding six months after birth by 59 percent. Working an additional eight hours at home per week increases the probability of breastfeeding by 9 and 21 percent at birth and six months after birth, respectively. Workplace characteristics show promise to effectively increase breastfeeding rates among working women and warrant additional consideration.

# CHAPTER 1. INTRODUCTION

There are well-established short- and long-term benefits of breastfeeding to mothers and children. Research has shown that breastfeeding is associated with health, cognitive, and educational benefits for children. For example, studies in the United States (U.S.) 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 enterocoloitis. In addition to the physiological health benefits, human milk may benefit children's cognitive development. Studies also suggest that breastfeeding is beneficial for the mother's health. 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 state, and reduced menstrual blood loss. Some evidence also demonstrates an improved sense of maternal self-esteem, bonding with infant, and success with mothering.

Both individuals and society accrue large benefits from breastfeeding. For example, one study finds that medical expenditures were 20 percent less for fully-breastfed infants compared to never-breastfed infants (Hoey and Ware 1997). In addition, an analysis by the U.S. Department of Agriculture's Economic Research Service estimates at least $3.6 billion in annual savings if the prevalence of exclusive breastfeeding was increased to those levels recommended by the Surgeon General (Weimer 2001). This figure reflects $3.1 billion in savings attributable to preventing premature deaths and $0.5 billion in savings associated with reduced medical expenses and indirect costs of time and earnings savings to parents. These estimates should be considered conservative as they only include the costs of three common infant illnesses. They do not include any health benefits to mothers or longer-term health benefits to children.

Reflecting research that indicates that both children and mothers benefit from breastfeeding, numerous individuals and organizations support and recommend breastfeeding. These individuals and organizations include the Surgeon General, American Pediatrics Association, American Medical Association, American Dietetic Association, American Academy of Family Physicians, and the World Health Organization. The 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" (U.S. DHHS 2000). The U.S. government has selected increasing breastfeeding rates as a *Healthy People 2010* objective alongside other national health goals such as decreasing rates of cancer, sexually transmitted diseases, obesity, and food insecurity. In addition, 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. Although researchers, public health organizations, and physicians generally agree on the importance of breastfeeding, a sizable percentage of the population does not breastfeed.

While a share of women does not breastfeed (29.9 percent in the hospital and 66.8 percent six months after birth in 2002), the likelihood of breastfeeding has oscillated over time and has varied by maternal characteristics. Between the early 1970s and 1982, there was an upward trend in breastfeeding rates. However, national breastfeeding rates exhibited a steady decline between 1983 and 1990. In 1991, breastfeeding rates, both for initiation and six months after birth, began to increase again. Between 1991 and 2002 breastfeeding rates for all mothers increased 16.8 percentage points (31.5 percent) at birth and 15.0 percentage points (82.4 percent) six months after birth (Ryan 2002).

Disparities in breastfeeding rates exist, with low-income, Black, less-educated, younger, and working women being less likely to breastfeed. For example, the difference in breastfeeding rates between working and non-working mothers is large; in 2002, 27.1 percent of mothers working full-time breastfed six months after birth compared to 35.2 percent of non-working mothers (Ryan 2002). Given the short- and long-term health benefits of breastfeeding to mothers and children, relatively low rates of breastfeeding among disadvantaged groups may contribute to well-established health disparities at all stages of the life cycle.

While these breastfeeding patterns are well-documented, the explanations for them are not. Because of the potential benefits of breastfeeding to approximately four million infants and mothers in the U.S. each year, this dissertation investigates three explanations of breastfeeding patterns identified in the literature that have not been previously tested empirically. This dissertation contributes to this important policy problem by investigating whether the following factors influenced breastfeeding over the last decade 1) demographic changes; 2) welfare work requirements; and 3) workplace characteristics.

The outline of the remainder of the dissertation is as follows. The following chapter examines whether demographic changes in the composition of births by select characteristics explain the increase in breastfeeding rates between 1991 and 2002. In Chapter 3, the effect of welfare work requirements on breastfeeding is examined. Chapter 4 investigates whether workplace characteristics affect breastfeeding rates at birth and six months after birth. The final chapter concludes.

# CHAPTER 2. INCREASING BREASTFEEDING RATES: DO CHANGING DEMOGRAPHICS EXPLAIN THEM?

## 2.1. INTRODUCTION

There are well-established short- and long-term health benefits of breastfeeding to children and mothers. Studies in the United States (U.S.) and abroad have found evidence that children who are breastfed have lower rates of urinary and respiratory tract infections, diarrhea, allergic diseases, otitis media, bacterial meningitis, botulism, bacteremia, and necrotizing enterocolitis.[1] Studies also suggest that breastfeeding is beneficial for the mother's health.[2] 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, and reduced menstrual blood loss.

Because of the potential health benefits of breastfeeding to approximately four million infants and mothers each year, fluctuations in breastfeeding rates are important to understand. Figures 2.1 and 2.2 show breastfeeding rates in the hospital (i.e., initiation) and six months after birth, respectively. Both figures illustrate that breastfeeding rates oscillated over time. Between the early 1970s and 1982, there was an upward trend in breastfeeding rates. However, breastfeeding rates exhibited a steady decline between 1983 and 1990. In 1991, both breastfeeding rates, initiation and six months after birth, began to increase again. Breastfeeding rates for all mothers increased 16.8 percentage points (31.5 percent) at birth and 15.0 percentage points (82.4 percent) six months after birth between 1991 and 2002 (Ryan 2002).[3]

[1] 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).
[2] For a review of the literature on the benefits of breastfeeding for mothers see Labbok (2001).
[3] These breastfeeding rates reflect any breastfeeding and not exclusive breastfeeding.

This chapter focuses on the rising breastfeeding rates from 1991 to 2002. Because it is highly likely that distinct factors played a role in breastfeeding decisions during each of the time periods, the years between 1991 and 2002 are the most applicable to today's breastfeeding setting. In addition, Figures 2.1 and 2.2 both illustrate that there is little noise in breastfeeding rates between these years, making this a reasonable time period to study.

While the literature agrees that breastfeeding rates increased between 1991 and 2002 (e.g., Ryan 2002; Ryan, Wenjun, and Acosta 2002; Wright 2001; Ryan 1997), explanations for the upward trend have yet to be investigated.[4] Wright (2001) offers several possible explanations for the rising breastfeeding rates during this period including: changing composition of births, breastfeeding promotion conducted through the Special Supplemental Program for Women Infants and Children (WIC), and the federal government's support and promotion of breastfeeding. However, Wright (2001) does not test any of these hypotheses. Additional uninvestigated factors that may influence these breastfeeding rates include workplace policies, state breastfeeding laws, technological innovation, and cultural norms.

This chapter contributes to the breastfeeding literature by studying one potential explanation for the upward trend in breastfeeding rates: demographic changes in the composition of births that occurred between 1991 and 2002. Shifts in the composition of births coupled with the fact that some groups of mothers are more likely to breastfeed than others could explain the increasing breastfeeding trends. For example, births to mothers with a college education increased 11.2 percentage points or 31.6 percent (NCHS 2003 and 1993), and mothers with more

[4] It is not surprising that other studies confirm the breastfeeding trends shown in Figures 2.1 and 2.2 as all of the studies, including this one, rely on data from the Ross Laboratories Mothers Survey. Data from the Ross Laboratories Mothers Survey are the only data available to generate annual breastfeeding rates. To examine the validity of the Ross Laboratories Mothers Survey data, Figure 2.1 demonstrates that data from the Ross Laboratories Mothers Survey are similar to those from other data collected one time or periodically. See Section 2.2 for further discussion of the Ross Laboratories Mothers Survey data.

education are more likely to breastfeed. Mothers with a college education were, on average, 30.2 percentage points more likely to initiate breastfeeding than mothers with a grade school education between 1991 and 2002 (Ryan 2002 and 2001). Mothers with a college education were also, on average, 16.5 percentage points more likely to breastfeed six months after birth over this same period (Ryan 2002 and 2001). Hence, this example illustrates how changes in the demographic composition of births could explain the upward trend in breastfeeding rates since 1991.

To examine whether increases in breastfeeding rates since 1991 can be attributed to demographic changes in births, this study decomposes breastfeeding trends using 1991 through 2002 data from the Ross Laboratories Mothers Survey and birth certificates. Findings suggest that changes in the composition of births by the following comprehensive set of demographic characteristics explain approximately 20 percent of the upward trend in initiation and duration breastfeeding rates: maternal age, maternal education, race/ethnicity, parity, and geographic location of birth. These findings underscore the importance of exploring the impact of other factors on breastfeeding rates such as public breastfeeding support programs, technological innovation, workplace characteristics, state breastfeeding laws, welfare policies, cultural norms, and WIC.

## 2.2. METHODOLOGY

Standard demographic decomposition techniques are used to determine the share of the increase in breastfeeding rates between 1991 and 2002 that demographic changes in the composition of births explain.

Equation 1 is used to calculate the actual breastfeeding rate initially and six months after birth.

$$BF_t = \sum_{s=1}^{N} bf_{t,s} * br_{t,s} \qquad (1)$$

In Equation 1, $BF_t$ is breastfeeding rate in year $t$; $bf_{t,s}$ is the breastfeeding rate in year $t$ for subgroup $s$ of demographic characteristic $S$; $br_{t,s}$ is the share of births born to mothers of subgroup $s$ of demographic characteristic $S$ in year $t$; and $N$ is the number of subgroups for the particular demographic characteristic $S$.

Estimated breastfeeding rates holding breastfeeding practices constant at their 1991 values while allowing the shares of births to vary over time are calculated using Equation 2.[5]

$$BF_{t,S} = \sum_{s=1}^{N} bf_{1991,s} * br_{t,s} \qquad (2)$$

In Equation 2, $BF_S$ is breastfeeding rate allowing a subgroup's share of births to vary; $bf_{1991,s}$ is the breastfeeding rate in 1991 for subgroup $s$; $br_{t,s}$ is the proportion of births born to mothers of subgroup $s$ in year $t$; and $N$ is the number of subgroups for the particular demographic characteristic $S$.

The approach taken to calculate these estimated breastfeeding rates is to individually change each demographic characteristic, thereby attributing to each characteristic the change caused by that factor alone. The disadvantage of this approach is that the sum of changes for all the characteristics may be greater than the total change that occurred. Other alternative approaches exist, but are not feasible given data limitations.[6] In addition, because of data restrictions it is not feasible to allow each subgroup's share of births to vary separately. Therefore, for a given demographic characteristic, all of its subgroups' shares vary simultaneously.

[5] Note that Equation 2 can be generalized to allow both breastfeeding rates and shares of births to a particular subgroup to vary. However, to answer the posed research question, it is only necessary to vary the birth shares

[6] An alternate approach, described by Cancian, Danzinger, and Gottschalk (1992), changes the values for each demographic characteristic sequentially with previously changed shares of births remaining at their new values. The downside of such a strategy is that results may vary by the order in which shares are changed.

A percent is then calculated to determine what proportion of the increase in breastfeeding rates between 1991 and 2002 can be attributed to changes in the birth composition by a particular demographic characteristic during the same time period. The numerator of this percent is the difference between the 2002 breastfeeding rate and the one expressed in Equation 2 that weights 1991 breastfeeding rates by 2002 share of births (See Equation 3.).

$$BF_{2002} - BF_{2002,S} = (\sum_{s=1}^{N} bf_{2002,s} * br_{2002,s}) - (\sum_{s=1}^{N} bf_{1991,s} * br_{2002,s}) \qquad (3)$$

The denominator is the difference between the actual 1991 and 2002 breastfeeding rates, $BF_{2002}$ - $BF_{1991}$. If demographic changes explain some of the increase in breastfeeding rates, then the percent would be positive.

***Data***

The breastfeeding data used in this study are from the Ross Laboratories Mothers Survey (RLMS), the only data set that can produce national breastfeeding trends.[7] RLMS, a proprietary survey of Ross Laboratories, is a large, national mail survey conducted since 1955 to determine patterns of milk feeding from birth to 12 months. Questionnaires are mailed to a probability sample of new mothers selected from a sample frame of names that represent approximately 50 to 85 percent of all national births; the list includes names from hospital records, county records of birth registrations, photography and diaper services, and newspapers. The samples are very large and have increased over time; 420,000, 720,000, and 1.4 million questionnaires were mailed in 1991, 1992, and 2000, respectively.

The RLMS asks mothers to recall the type of milk her baby was fed in the hospital, at

[7] For more information on other breastfeeding data sources and their advantages and disadvantages relative to the RLMS, see Jacknowitz (2002) and Grummer-Strawn and Li (2000).

week one of age, in the last thirty days, and in the last week.[8] In addition, mothers are asked about the following five demographic characteristics: maternal age, maternal education, race/ethnicity, parity, and Census division of residence (hereafter referred to as geographic location of birth).[9] Breastfeeding rates at the following two points in time after birth are available to the public stratified by these demographic characteristics: initiation and six months after birth. While breastfeeding rates are only available by five demographic characteristics, all of the most likely candidates to explain breastfeeding trends are included.

Several drawbacks of using the RLMS for this analysis exist. Because the data are proprietary, the underlying individual-level data are not available to the public, and this analysis must rely on the aggregate data provided by Ross Laboratories. Aggregate breastfeeding estimates by maternal characteristic for 1991 through 2002 are extracted directly from tabulations available in Ryan (2002 and 2001). This limits the methods used in the study as it is not possible to change the demographic characteristics sequentially or allow the share of births to each demographic subgroup to vary individually. In addition, this analysis must rely on the RLMS variable classifications. The other major limitation of using the RLMS is that the data are not nationally-representative as the sampling frame represents only 50 to 85 percent of new births depending upon the year and the response rate is low with an average of approximately 45 percent over the last decade.

Despite concerns that the RLMS data are not representative of U.S. breastfeeding rates, Figure 2.1 and other studies illustrate that breastfeeding rates produced with the RLMS are

[8] Starting in 1997, Ross Laboratories mailed their survey to mothers with infants one month of age, two months of age, three months of age up to twelve months of age. In earlier years, surveys were mailed to mothers when their infants were six or twelve months of age. Respondents were asked to recall the type of milk fed to their infants immediately after birth, in the hospital, and during each of the first twelve months of life.

[9] Other characteristics available include: maternal employment, WIC participation, and low birth-weight. The analysis does not consider low birth-weight data because the aggregate tabulations only include breastfeeding rates for low birth-weight infants and all infants (including low birth-weight babies). Because of data limitations, breastfeeding rates can not be calculated for non-low birth-weight babies.

comparable to those from other sporadically collected data. Figure 2.1 shows breastfeeding rates from the RLMS, National Health and Examination Survey (NHANES), National Maternal and Infant Health Survey (NMIHS), National Survey of Family Growth (NSFG), and the Food and Drug Administration's Infant Feeding Practices Survey (FDA-IFPS). All of these comparison data sources are nationally-representative with approximate response rates above 70 percent. Four of these five data sets provide similar estimates of breastfeeding initiation for all mothers with the only exception being the FDA-IFPS. Comparisons of the FDA-IFPS with the NMIHS data indicate that women in the FDA-IFPS sample are more likely to be in middle-and upper-income groups, older, married, and White than the NMIHS sample (Fein and Roe 1998). These characteristics are associated with higher breastfeeding rates, which is consistent with the higher estimates generated using the FDA-IFPS. Studies (Hediger et al. 2001; Ryan et al. 1991) that compared breastfeeding estimates from the NHANES, NSFG, and RLMS also found similar breastfeeding rates among data sets.

In addition to breastfeeding statistics, data on the composition of births from 1991 to 2002 are necessary to complete the proposed analysis. This study uses birth data extracted from 100 percent of birth certificates registered in the fifty states and the District of Columbia. Because these data are a near census of births for a given year, they are ideal to use for this study.[10] Also available are a variety of maternal characteristics including those present in the RLMS tabulations. The share of births born to women in a given demographic group is extracted from the *National Vital Statistics Reports* series, which was previously titled the *Monthly Vital* Statistics Reports series.

***Choosing Demographic Characteristics to Study***

[10] These data are most likely a near census of births because a small fraction of births probably go unreported. However, most mothers, including illegal immigrants, have an incentive to register their births.

To choose which of the demographic characteristics available in the RLMS to study, this chapter utilities two criteria. Are there sizeable differences in breastfeeding rates between mothers by this characteristic? For example, are mothers with a college education more likely to breastfeed than mothers with a grade school education? Second, has the composition of births changed by this characteristic between 1991 and 2002? In other words, has the share of births to college-educated women changed during the time period of interest?

To address whether differences exist in breastfeeding rates between women by a given characteristic, this chapter turns to breastfeeding trends and the breastfeeding literature. Jacknowitz (2002) identifies breastfeeding correlates by graphing trends in breastfeeding practices by subgroup and conducting a literature review. Graphing breastfeeding trends by subgroup illustrates whether one group of mothers exhibits consistently different breastfeeding rates from other groups. However, to determine whether these differences are statistically significant and persist after controlling for other variables, studies from the breastfeeding literature are reviewed. Studies included in the literature review use multivariate regression techniques to predict correlates of breastfeeding practices.

An examination of the breastfeeding trends and the literature review suggest that of those demographic characteristics available in the RLMS, maternal age, maternal education, race/ethnicity, and geographic location of birth are strong correlates of breastfeeding, but parity is not. Breastfeeding trends and studies confirm a positive correlation between age of mother at time of birth and initial and duration breastfeeding rates (Roe et al. 1999; Fein and Roe 1998; Visness and Kennedy 1997). Less educated mothers are less likely to breastfeed than more educated mothers. Multivariate studies confirm that maternal education has a positive effect on breastfeeding behavior initially and later (Forste et al. 2001; Roe et al. 1999; Fein and Roe 1998;

Baydar et al.1997; Visness and Kennedy 1997; Lindberg 1996a). Further, Forste et al. (2001) find that women with a college education are almost twice as likely to breastfeed as women with only a high school degree or less.

Non-Hispanic Black mothers are less likely than mothers of other race/ethnicities to breastfeed at all points in time after birth. Multivariate studies generally find that the lower breastfeeding rates for non-Hispanic Black mothers compared to mothers of other race/ethnicities persist when other factors are held constant (Forste et al. 2001; Baydar et al. 1997). For example, Forste et al. (2001) find that non-Hispanic Black women are 2.5 times less likely to breastfeed than non-Hispanic White women. While multivariate studies generally agree that non-Hispanic Black mothers are less likely to breastfeed than non-Hispanic White and Hispanic mothers, it is not clear whether non-Hispanic White and Hispanic mothers have different breastfeeding rates.

Parity, defined as the birth order of the child, is not strongly associated with breastfeeding rates and is excluded from further analysis. Although the breastfeeding trends by parity suggest mothers are more likely to breastfeed their first child than later children at all points in time, the differences in breastfeeding initiation between the two groups averages only 4.4 percentage points. Furthermore, the association changes direction six months after birth, at which time women are more likely to breastfeed higher-order children than first-born. However, the difference is very small with an average of 3.1 percentage points. Given the weak descriptive evidence, it is not surprising that studies controlling for other correlates of breastfeeding rates have mixed results regarding the importance of parity in breastfeeding decisions (Forste et al. 2001; Roe et al. 1999; Fein and Roe 1998; Baydar et al. 1997; Visness and Kennedy 1997; Lindberg 1996a).

Mothers residing in the Western states (Mountain and Pacific Census regions) have much higher initial breastfeeding rates as well as higher rates six months later; while, mothers living in the East South Central division have considerably lower breastfeeding rates than all other regions at all points in time after birth. Multivariate studies confirm that region is an important determinant of initial breastfeeding behavior and the duration (Forste et al. 2001; Visness and Kennedy 1997). Specifically, residing in the Western region at the time of birth has a positive effect on breastfeeding initiation and duration (Forste et al. 2001; Visness and Kennedy 1997). Fein and Roe (1998) is the only study considered that does not find an effect of region on breastfeeding rates.

The second criterion for determining which variables to decompose is whether the birth composition by these variable changed. Table 2.1 illustrates that large changes occurred by maternal age, maternal education, and race/ethnicity. Between 1991 and 2002, births to women ages 30 and above increased 6.5 percentage points (21.3 percent) and births to women with a college education increased 11.2 percentage points (31.6 percent). Births to Hispanic mothers, who are more likely to breastfeed than non-Hispanic Black mothers, increased 6.6 percentage points. At the same time births to non-Hispanic White mothers, who are also more likely to breastfeed than non-Hispanic Black mothers, declined by 5.9 percentage points. These changes considered together suggest that compositional changes in the race/ethnicity of births may not influence overall breastfeeding rates because while race/ethnicity is associated with breastfeeding rates these two effects may cancel each other out. The one demographic variable

that did not undergo compositional changes in births and is excluded from the following analysis is geographic location of birth.[11]

This exercise is performed for all years between 1991 and 2002 for the three demographic characteristics that were identified in the previous section: maternal age, maternal education, and race/ethnicity. The subgroups of maternal age at birth include: <20 years, 20-24 years, 25-29 years, 30-34 years, and >35 years. These groups and those for maternal education and race/ethnicity are determined by the RLMS tabulations. Maternal education subgroups are: grade school, high school, non-college, college, and unknown. Finally, the subgroups for race/ethnicity are: Hispanic, non-Hispanic Black, non-Hispanic White, and other. Also, decompositions will be performed for both breastfeeding initiation and six months after birth because differences in breastfeeding rates between subgroups may differ for the two outcomes (See Table 2.2.). For example, there are larger differences in breastfeeding initiation between more educated and less educated mothers than in breastfeeding six months after birth.

Mothers with unknown education and other race/ethnicity are assigned the mean breastfeeding rate for all mothers. To test whether this is a reasonable strategy, 1991 and 2002 actual breastfeeding rates are compared with ones that weight each subgroup's breastfeeding rate by the proportion of births to that given subgroup of a demographic variable. If assigning the other and unknown subgroups the mean breastfeeding rate for all mothers is a reasonable strategy, we would expect the actual and weighted breastfeeding rates to be very close. Indeed, the six estimated breastfeeding rates (1991 and 2002 rates by maternal education, maternal age, and race/ethnicity) are within one percentage point of those produced by the RLMS.

**2.3. RESULTS**

[11] To ensure that geographic location of birth did not explain any of the increasing breastfeeding trends, breastfeeding rates are decomposed by Census division of birth. The results, not presented in the chapter, show that geographic location of birth explains 0 percent of the increasing breastfeeding trends.

Figures 2.3 and 2.4 graph the actual breastfeeding rates and the estimated breastfeeding rates by year initially and six months after birth, respectively. Both of these figures show that the differences between the actual and estimated breastfeeding rates grow over time with the estimated breastfeeding rates remaining fairly constant over time. These graphs suggest that changes in the composition of births explain some of the increasing trends in initial breastfeeding rates and breastfeeding rates six months after birth.

Table 2.3 shows that changes in the share of births by maternal age explain 9.8 percent of the increase in breastfeeding rates. The change in the share of birth by maternal education explains 11.5 percent of the increasing breastfeeding rates. As expected, changes in shares of births to mothers of different race/ethnicity explain none of the increase in breastfeeding rates since 1991. In fact, applying the 2002 composition of births by race/ethnicity to the appropriate 1991 breastfeeding rates results in a lower overall breastfeeding rate implying that breastfeeding rates would have been higher if compositional changes in births by race/ethnicity had not occurred.

Similar to the findings for the initiation of breastfeeding, Table 2.3 illustrates that changes in the composition of births explain very little of the increase in breastfeeding rates six months after birth since 1991. The shift of births by maternal age explains only 10.2 percent of the increase in breastfeeding rates. The changes in the birth shares by maternal education explain only 9.0 percent of the increasing breastfeeding rates six months after birth. This statistic is approximately 2.5 percentage points lower than the number for the initiation of breastfeeding rates. This is because differences in breastfeeding rates between the most and least educated mothers are larger for initiation (on average 30.2 percentage points) than duration (on average 16.5 percentage points). Finally, changes in the racial/ethnic composition of births account for

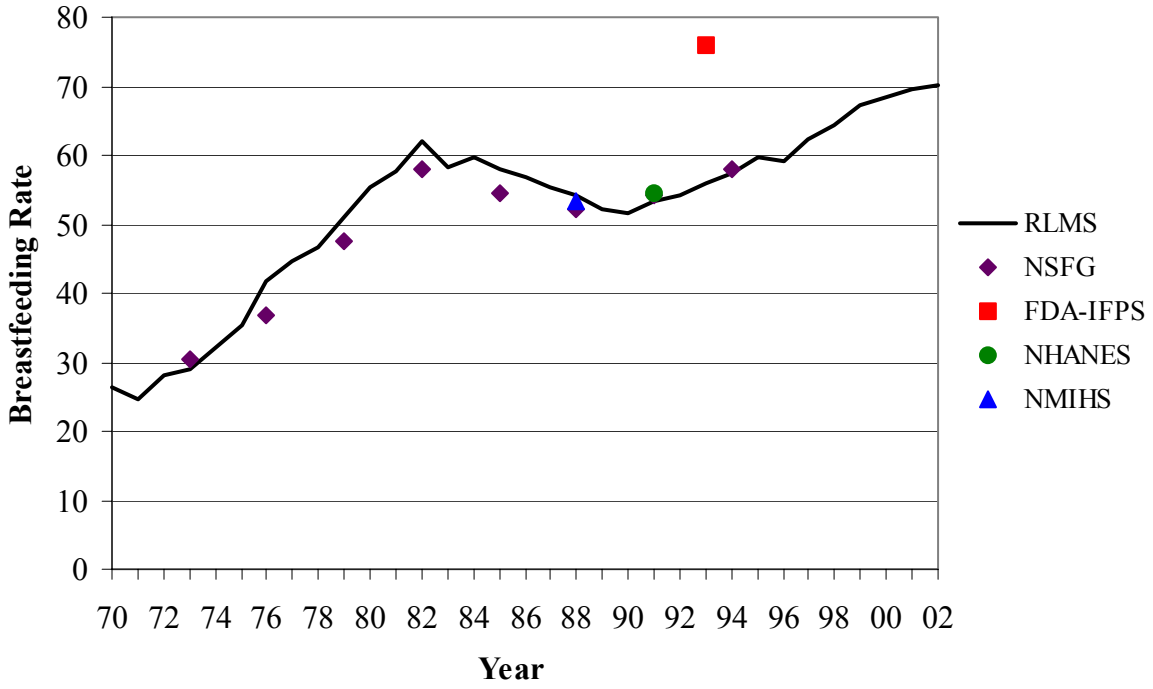
essentially none of the increasing breastfeeding rates. Similar to the case with breastfeeding initiation, applying the 2002 composition of births by race/ethnicity to the appropriate 1991 breastfeeding rates results in a lower overall breastfeeding rate.

## 2.4. DISCUSSION AND CONCLUSION

This chapter examines whether increases in breastfeeding rates since 1991 can be attributed to demographic changes. To answer the research question this study decomposes breastfeeding trends using 1991 through 2002 data from the Ross Laboratories Mothers Survey and birth certificate data. Findings suggest that changes in the composition of births by the following demographic characteristics explain approximately 20 percent of the upward trend in initiation and duration breastfeeding rates: maternal age, maternal education, race/ethnicity, parity, and geographic location of birth. Such characteristics include all of the most likely demographic factors to explain breastfeeding trends. Changing birth compositions by maternal age and education, explain 9.8 and 11.5 percent of the increase in breastfeeding initiation rates, respectively. Changing birth compositions by maternal age and education explain 10.2 and 9.0 percent of increasing breastfeeding rates six months after birth, respectively. These findings underscore the importance of exploring the effects of other factors on breastfeeding rates such as public breastfeeding support programs, technological innovations, workplace characteristics, state breastfeeding laws, welfare policies, cultural norms, and WIC.

## FIGURES AND TABLES

**Figure 2.1. Breastfeeding Initiation Rates for All Mothers, 1970-2002**




Notes: This is an updated figure from Jacknowitz (2002). Data are from the following sources: RLMS data are from Ryan (2002); NSFG data are from NCHS (1998); FDA-IFPS data are from Fein and Roe (1998); NHANES data are from Burstein et al. (2000); and NMIHS data are from Visness and Kennedy (1997).

**Figure 2.2. Breastfeeding Rates Six Months After Birth for All Mothers, 1971-2002**


Notes: Data are from Ryan (2002). Data on breastfeeding duration are available starting in 1971, not 1970, which is the starting year for the breastfeeding initiation time series.

**Figure 2.3. Decomposition of Initiation Breastfeeding Rates, 1991-2002**

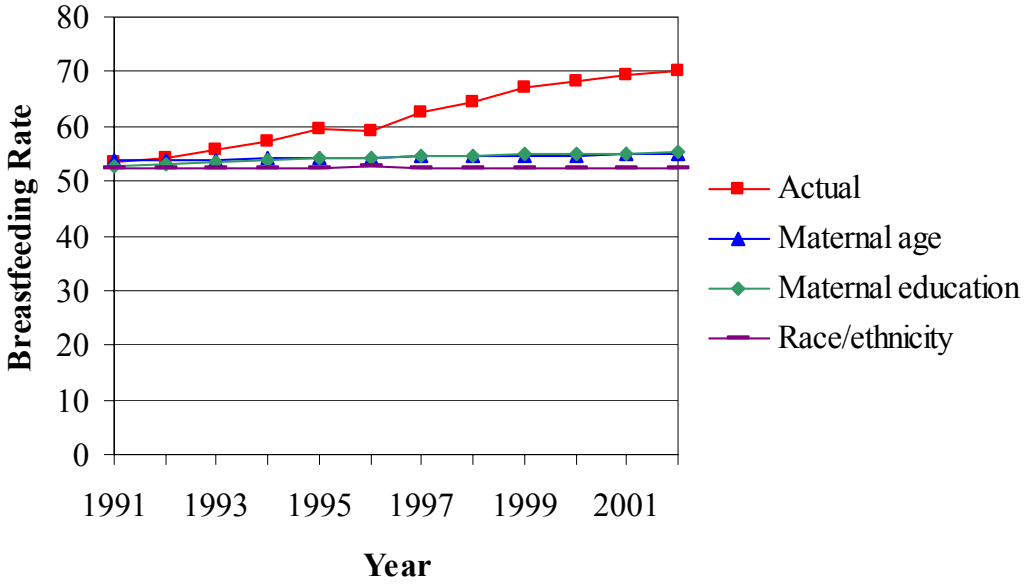
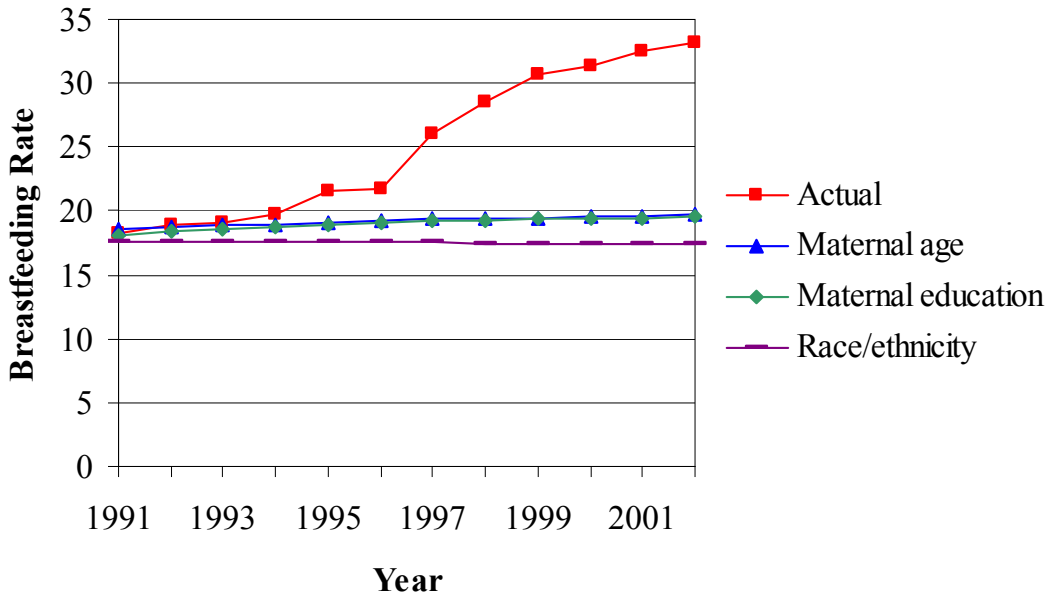


**Figure 2.4. Decomposition of Breastfeeding Rates Six Months After Birth, 1991-2002**




Notes: The maternal age, maternal education, and race/ethnicity breastfeeding rates are calculated by weighting the 1991 breastfeeding rate by the year's share of births to each demographic subgroup. Mothers with unknown education are assigned the breastfeeding rate for all mothers. Mothers with other race/ethnicity are also assigned the breastfeeding rate for all mothers.

**Table 2.1. Composition of Births by Selected Characteristics, 1991 and 2002**

| | Percentage of births | | |
|---|---|---|---|
| | **1991** | **2002** | **Change** |
| ***Maternal age*** | | | |
| <20 years | 12.9 | 10.8 | -2.2 |
| 20-24 years | 26.5 | 25.4 | -1.1 |
| 25-29 years | 29.7 | 26.4 | -3.3 |
| 30-34 years | 21.5 | 23.7 | 2.1 |
| 35+ years | 9.4 | 13.8 | 4.4 |
| ***Maternal education*** | | | |
| Grade school | 6.1 | 6.0 | -0.1 |
| High school | 16.5 | 15.3 | -1.2 |
| Non-college | 34.9 | 30.7 | -4.2 |
| College | 35.5 | 46.7 | 11.2 |
| Unknown | 7.1 | 1.3 | -5.7 |
| ***Race/ethnicity*** | | | |
| Hispanic | 15.2 | 21.8 | 6.6 |
| Non-Hispanic, Black | 16.2 | 14.4 | -1.8 |
| Non-Hispanic, White | 63.0 | 57.1 | -5.9 |
| Other | 5.6 | 6.7 | 1.1 |
| ***Census division*** | | | |
| New England | 4.7 | 4.2 | -0.5 |
| Middle Atlantic | 14.2 | 12.7 | -1.5 |
| East North Central | 16.2 | 15.2 | -1.0 |
| West North Central | 6.5 | 6.6 | 0.1 |
| South Atlantic | 16.7 | 18.0 | 1.3 |
| East South Central | 5.7 | 5.8 | 0.1 |
| West South Central | 11.5 | 13.1 | 1.5 |
| Mountain | 5.9 | 7.6 | 1.7 |
| Pacific | 18.6 | 16.9 | -1.6 |
| Total births | 4,110,907 | 4,021,726 | |

Notes: The 1991 birth data are from NCHS (1993) and the 2002 birth data are from NCHS (2003). The 1991 unknown education category is primarily comprised of births from Washington and New York states (excluding New York City), which did not collect education information. 16,341 of the 1991 other race/ethnicity births are from New Hampshire, which did not collect race/ethnicity data.

**Table 2.2. Breastfeeding Rates by Selected Characteristics, 1991 and 2002**

| | Breastfeeding rate in hospital | | | Breastfeeding rate six months after birth | | |
|---|---|---|---|---|---|---|
| | **1991** | **2002** | **Change** | **1991** | **2002** | **Change** |
| ***Maternal age*** | | | | | | |
| <20 years | 32.2 | 56.2 | 24.0 | 5.9 | 16.7 | 10.8 |
| 20-24 years | 45.7 | 66.0 | 20.3 | 11.4 | 25.4 | 14.0 |
| 25-29 years | 57.8 | 73.4 | 15.6 | 19.7 | 35.7 | 16.0 |
| 30-34 years | 65.2 | 76.4 | 11.2 | 27.3 | 42.3 | 15.0 |
| 35+ years | 66.7 | 74.1 | 7.4 | 32.9 | 43.1 | 10.2 |
| ***Maternal education*** | | | | | | |
| Grade school | 35.2 | 55.1 | 19.9 | 12.6 | 27.1 | 14.5 |
| High school | 42.9 | 60.7 | 17.8 | 12.2 | 23.4 | 11.2 |
| Non-college | 42.6 | 60.5 | 17.9 | 12.2 | 23.5 | 11.3 |
| College | 70.2 | 81.2 | 11.0 | 27.7 | 44.6 | 16.9 |
| Unknown | N/A | N/A | | N/A | N/A | |
| ***Race/ethnicity*** | | | | | | |
| Hispanic | 51.8 | 70.7 | 18.9 | 14.8 | 32.7 | 17.9 |
| Non-Hispanic, Black | 25.8 | 53.9 | 28.1 | 6.6 | 19.2 | 12.6 |
| Non-Hispanic, White | 59.2 | 73.4 | 14.2 | 21.0 | 36.0 | 15.0 |
| Other | N/A | N/A | | N/A | N/A | |
| ***Census division*** | | | | | | |
| New England | 55.9 | 73.3 | 17.4 | 19.7 | 37.0 | 17.3 |
| Middle Atlantic | 48.3 | 65.5 | 17.2 | 16.8 | 33.2 | 16.4 |
| East North Central | 48.8 | 66.7 | 17.9 | 16.6 | 28.7 | 12.1 |
| West North Central | 56.4 | 73.1 | 16.7 | 18.9 | 35.2 | 16.3 |
| South Atlantic | 46.4 | 67.5 | 21.1 | 14.5 | 31.2 | 16.7 |
| East South Central | 37.5 | 57.0 | 19.5 | 10.7 | 22.0 | 11.3 |
| West South Central | 48.4 | 64.9 | 16.5 | 14.0 | 27.3 | 13.3 |
| Mountain | 70.0 | 81.0 | 11.0 | 28.0 | 40.5 | 12.5 |
| Pacific | 69.5 | 81.5 | 12.0 | 25.7 | 43.4 | 17.7 |

Notes: Data are from Ryan (2001 and 2002). Breastfeeding rates are unavailable for mothers with unknown education or other race/ethnicity.

**Table 2.3. Decomposition of Breastfeeding Rates**

| | Breastfeeding rate | |
|---|---|---|
| | In hospital | Six months after birth |
| Actual 1991 breastfeeding rate | 53.3 | 18.2 |
| Actual 2002 breastfeeding rate | 70.1 | 33.2 |
| Change in breastfeeding rate | 16.8 | 15.0 |
| ***Maternal age*** | | |
| (1) Estimated 2002 breastfeeding rate | 54.9 | 19.7 |
| (2) Difference between actual 1991 and estimated 2002 breastfeeding rates | 1.6 | 1.5 |
| (3) Percent of breastfeeding increase explained | 9.8 | 10.2 |
| ***Maternal education*** | | |
| (1) Estimated 2002 breastfeeding rate | 55.2 | 19.5 |
| (2) Difference between actual 1991 and estimated 2002 breastfeeding rates | 1.9 | 1.3 |
| (3) Percent of breastfeeding increase explained | 11.5 | 9.0 |
| ***Race/ethnicity*** | | |
| (1) Estimated 2002 breastfeeding rate | 52.4 | 17.4 |
| (2) Difference between actual 1991 and estimated 2002 breastfeeding rates | -0.9 | -0.8 |
| (3) Percent of breastfeeding increase explained | -5.4 | -5.4 |

Notes: Estimated 2002 breastfeeding rate is calculated by weighting the 1991 breastfeeding rate by the 2002 share of births to each demographic subgroup. Mothers with unknown education are assigned the breastfeeding rate for all mothers. Mothers with other race/ethnicity are also assigned the breastfeeding rate for all mothers.

# CHAPTER 3. WELFARE WORK REQUIREMENTS AND CHILD WELL-BEING: EVIDENCE FROM THE EFFECTS ON BREASTFEEDING

*(with Steven Haider and Bob Schoeni)*

## 3.1. INTRODUCTION

Federal welfare policy changed fundamentally with the passage of the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996. Policy decision-making was shifted to the state and even county level, which gave rise to the adoption of a myriad of different policies across the nation. However, in almost every locale, emphasis was placed squarely on families becoming self-sufficient through employment.

Numerous observational studies have examined the causal impact of these reforms on children and families, but most of these studies suffer from two methodological limitations. First, most of the observational studies rely on outcomes that are fairly indirect measures of child well-being, such as welfare participation, employment, earnings, and income.[12] One explanation for this focus is that many of the dimensions of well-being that are of interest—education, cognitive development, and health status—do not change quickly, implying that potential policy impacts will only be observed in the long-run. Second, relatively few studies have estimated the impact of specific policies that were adopted during the reform period but instead estimate the impact of the total bundle of adopted policies.[13] However, only through understanding the impact of specific policies can states appropriately modify the policy bundle they have chosen.

This study, which examines the impact of welfare reform on breastfeeding, addresses both of these limitations. Breastfeeding is closely related to well-being as the short-term and long-term health benefits to children and mothers are well documented. Moreover, breastfeeding

[12] Two exceptions are Paxson and Waldfogel (2003) who examine child abuse and neglect and Meyer and Sullivan (2001) who examine consumption.

[13] Some exceptions include Grogger (Forthcoming); Ziliak et al. (2000); CEA (1999); and Rector and Youssef (1999).

prevalence is an outcome that can be affected in the short-term; thus, any impacts of the recent reforms can be estimated more easily than when examining outcomes that change more slowly, such as completed years of education or cognitive development. The specific reforms that are expected to affect breastfeeding are ones that impact mothers with infants. This study quantifies the specific policies—work requirements for mothers with a six-month old child and sanctions for not satisfying these requirements—and estimates their impact.

There is reason to suspect that welfare reforms could be causing a reduction in breastfeeding. Previous research has found a positive causal impact of welfare reforms on employment and a negative correlation between employment and breastfeeding. If such employment effects were to exist among mothers with infants, then welfare reform could be causing some new mothers to enter the workforce and, in turn, stop breastfeeding.

Our basic identification strategy relies on comparing the change in breastfeeding in states that adopted stringent work policies versus the change in states that adopted lenient policies. Relying on national data for the period 1990 to 2000, we find that work requirements reduce breastfeeding substantially. Our preferred estimates imply that the most stringent work requirements cause the breastfeeding rate six months after birth to decline 3.1 percentage points (22 percent) for new mothers enrolled in the Special Supplemental Program for Women, Infants, and Children (WIC) and 2.1 percentage points (9 percent) for all new mothers. These results imply that, if the nation had not adopted the reforms that were implemented in 1996 and subsequent years, national breastfeeding would have been 5.5 percent higher than it actually was in 2000. Such negative impacts of particular policies (full-family sanctions coupled with moderate to high hours requirements) must be weighed against potential benefits as states develop and refine their overall welfare programs.

## 3.2. BACKGROUND

In this section, we first review the relevant breastfeeding literature and the welfare reform literature. We then briefly sketch a conceptual framework that guides our analysis.

### *Breastfeeding Literature*

Numerous studies conclude that human milk is the gold standard for infant nourishment (see Lawrence (2000) and American Academy of Pediatrics (1997) for useful reviews). For example, studies have found that human milk is associated with lower rates of urinary tract infections, lower and upper respiratory tract infections, diarrhea, allergic diseases, otitis media, bacterial meningitis, botulism, bacteremia, and necrotizing enterocolitis for infants and children (e.g., Beaudry, Dufour, and Marcoux 1995; Duncan et al. 1993). In addition to the physiological health benefits, human milk also benefits children's cognitive and educational abilities (e.g., Horwood and Fergusson 1998; Lucas et al. 1992).

Studies also suggest that breastfeeding is beneficial for the mother's health (see Labbok (2001) for a useful review). The list of beneficial 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 state, and reduced menstrual blood loss (e.g., McTiernan and Thomas 1986). Some evidence further demonstrates an improved sense of self-esteem, bonding with infant, and success with mothering (e.g., Locklin and Naber 1993).

Given that the benefits of breastfeeding are well established, barriers to breastfeeding have clinical and policy significance. One potential barrier is maternal employment. Research has documented a negative correlation between full-time maternal employment and the duration of breastfeeding (see Lindberg (1996b) for a useful review). Results are mixed on how part-time

employment affects breastfeeding rates compared to those not working, with some studies finding a significant difference (Lindberg 1996a) while others do not (Fein and Roe 1998).

***Welfare Reform Evaluation Literature***

The 1996 federal welfare legislation PRWORA, which replaced AFDC (Aid for Families with Dependent Children) with TANF (Temporary Assistance for Needy Families), changed welfare policy in two important respects: it increased the emphasis on work and it gave states greater discretion in designing their programs. Some policies that states enacted include lifetime limits for welfare receipt, higher earnings disregards, family caps, and work participation requirements (Rowe 2000).

There have been numerous experimental studies of welfare-to-work programs (see Grogger, Karoly, and Klerman (2002) and Hamilton et al. (2001) for useful reviews). These studies generally find that welfare-to-work programs modestly increase labor supply, particularly when the policies are coupled with some type of enforcement mechanism. In addition to the employment effects, the experimental studies find that the programs do not lead to higher total family income because the increased earnings were offset by reductions in welfare transfer income. Furthermore, studies have found little impact on children's well-being.

Although these experimental studies provide important evidence on the likely impacts of welfare reform, they suffer from at least one significant drawback: most experimental designs only include individuals who initially participated in welfare, and therefore they are not informative regarding individuals who did not enroll in welfare due to the reforms. Grogger, Haider, and Klerman (2003) conclude that reductions in entry accounted for roughly half of the decline in welfare caseloads in the 1990s, implying that the experimental studies could substantially misstate the impact of reforms.

In addition to the experimental evidence, several studies using observational data have attempted to identify the causal impacts of the various welfare policies. These causal studies of the reforms have usually focused on the welfare caseload (e.g., Grogger forthcoming; Ziliak et al. 2000; CEA 1999 and 1997). Such studies cannot provide information regarding whether or not potential recipients are made better off by the reforms. A few recent observational studies focus on employment, income, poverty, and family structure (e.g., Grogger forthcoming; Bitler, Gelbach, and Hoynes 2003; Ellwood 2000; Moffitt 1999; Schoeni and Blank 1999). Consistent with the experimental evidence, these studies tend to conclude that welfare reform contributed to the rise in employment among low-income mothers (Grogger forthcoming; Meyer and Rosenbaum 2001; O'Neill and Hill 2001; Moffitt 1999; Schoeni and Blank 1999).

***A Simple Conceptual Framework***

A new mother will decide when to stop breastfeeding (and whether to initiate breastfeeding) by evaluating its underlying costs and benefits. This decision is made continually over time as new information and constraints arise. Employment can potentially increase the cost of choosing to rely on breast milk, depending on a mother's flexibility to breastfeed or pump during the workday and a mother's access to pump and cooler technology (Hills-Bonczyk et al. 1993). When the breastfeeding costs associated with work are sufficiently high, then policies that increase the labor supply of mothers will adversely impact the prevalence of breastfeeding. However, it is not clear that mandated work would increase the cost sufficiently to cause a woman to stop breastfeeding, nor is it clear that the women who are directly impacted by welfare-to-work laws would have breastfed in the absence of the law. Moreover, the change in labor force attachment induced by welfare policies may increase total income, which in turn may

increase breastfeeding, all else equal. The goal of the empirical analysis is to estimate the net effect of the policy changes on breastfeeding.

Very few states require mothers to work within the first few weeks after birth; therefore, any impact on breastfeeding in the hospital (which we can measure in our data) can be interpreted as an anticipatory effect. Specifically, mothers may decide not to breastfeed in the hospital because they expect that the work requirements they will face a few months after birth will cause them to enter the workforce and, in turn, stop breastfeeding. This anticipatory effect will tend to be small if the costs of learning to breastfeed are small or if the perceived benefits of breastfeeding are relatively high within the first few months after birth.

Given previous research, we expect anticipatory effects to be small. Ryan (2000) finds nearly identical breastfeeding rates in the hospital for women who are employed and not employed (67.7 percent for those employed vs. 68.0 percent for those not employed), but the rates diverge at six months (26.6 vs. 35.4 percent) and at twelve months (13.6 vs. 22.0 percent). In addition, previous research suggests that the benefits of breastfeeding are highest within the first few months after birth (American Academy of Pediatrics 1997).

## 3.3. THE DATA

To examine the impact of changing welfare laws on breastfeeding, we require data on breastfeeding that enable us to examine state-by-state variation over the 1990s, when welfare policies were changing rapidly across states. Aggregate breastfeeding data from the Ross Laboratories Mothers Survey (RLMS) are the only suitable data that are publicly available.[14]

### *Breastfeeding Rates*

[14] The RLMS data are used by the National Institute of Health to monitor the *Healthy People 2010* objective to increase U.S. national breastfeeding rates. See Grummer-Strawn and Li (2000) for a review of the available data on breastfeeding.

RLMS, a proprietary survey of Ross Laboratories, is a large, national mail survey conducted since 1955 to determine patterns of milk feeding from birth to 12 months. Mothers are asked to recall the type of milk their baby was fed in the hospital, at week one of age, in the last 30 days, and in the last week.[15] Questionnaires are mailed to a probability sample of new mothers selected from a list of names that represent approximately 80 to 85 percent of all national births, where the list includes names from hospital sources, county records of birth registrations, photography and diaper services, and newspapers. The samples are very large, with 420,000, 720,000, and 1.4 million questionnaires mailed in 1991, 1992, and 2000, respectively. Such large sample sizes allow relatively precise state-by-state estimates in each year. See Ryan (2000 and 1997) for additional information on the RLMS.

Despite the incomplete coverage of the RLMS and a low response rate that is common among mail surveys (approximately 45 percent over the time period of interest), its national breastfeeding prevalence estimates are very similar to those produced using several other well known national surveys, including the National Survey of Family Growth (NSFG) and the National Health and Nutrition Examination Survey (NHANES) III (Hediger et al. 2001; Ryan et al. 1991). Moreover, national trends in breastfeeding (from 1955 to 1987) and differentials across socio-demographic characteristics are similar in the RLMS and the NSFG (Ryan et al. 1991).

Although the underlying RLMS micro-data are proprietary and are not made available to researchers outside Ross Laboratories, annual estimates of four different breastfeeding rates for the 50 states and the District of Columbia are published (Ryan 2000). These four rates are for all

[15] Starting in 1997, Ross Laboratories mailed their survey to mothers with infants one month of age, two months of age, three months of age, etc., up to twelve months of age. In earlier years, surveys were mailed to mothers when their infants were six or twelve months of age. Respondents were asked to recall the type of milk fed to their infants immediately after birth, in the hospital, and during each of the first 12 months of life. The one complication that this change in design causes is that sample sizes are smaller in later years, implying that the aggregate data are heteroskedastic over time.

new mothers in the hospital just after giving birth, all mothers six months later, WIC mothers in the hospital just after giving birth, and WIC mothers six months later. In these data, a WIC mother is defined as any new mother who received WIC for herself or her infant at any time after the birth of the child, including the six-week postpartum period of benefits granted to pregnant WIC recipients. We use these data for the years 1990 through 2000 as the outcomes in our analysis.

In Table 3.1, we present national estimates of the four different breastfeeding rates by year based on the RLMS aggregate data. Two important patterns emerge from the estimates in Table 3.1. First, there was a secular increase in breastfeeding in the United States (U.S.) for all new mothers and for WIC mothers. The increase, which occurred both in the hospital and six months after birth, corresponds with the growing belief that breast milk is the optimal source of infant nutrition. Second, breastfeeding prevalence six months after birth is substantially less than the prevalence in the hospital. Thus, many women who begin breastfeeding do not continue breastfeeding for the six to twelve months recommended by the American Academy of Pediatrics (1997).

***Welfare Policies***

Because of the numerous policy changes that were enacted as part of welfare reform and the significant variation in policies across states, it is difficult to develop a parsimonious yet meaningful classification of state policies. For our purposes, we classify states based on their policies that directly relate to the work requirements for mothers of six-month old infants (corresponding to the RLMS breastfeeding data). We construct this classification based on three work policies: (1) whether any work is required for mothers of six-month old infants, (2) the minimum number of hours of work that are required, and (3) sanction policies.

Our primary source for information on welfare policies is the Urban Institute's Welfare Rules Database (WRD);[16] see Rowe (2000) for a useful summary of the WRD. We supplement these data with information on sanction policies from the Council of Economic Advisors (CEA) (1999). In addition, when information on hours requirements were not available in the WRD, either because it was missing or states determined hours requirements on a case by case basis, we use data on hours requirements from the State Policy Documentation Project (SPDP). The SPDP contains information on the actual implementation of hours requirements.[17]

The first policy component that we consider is whether there are any work requirements for a mother with a six-month old infant. Before TANF, some states had instituted work requirements, but all states exempted mothers with a child under 36 months old. PRWORA mandated that all states adopt work requirements for its general welfare population but allowed states latitude in exempting mothers of young children from these work requirements. By 2000, young-child exemptions ranged from 0 to 48 months across the 50 states and the District of Columbia, with approximately 60 percent of states having an exemption of more than six months. However, even the states that allow young-child exemptions often place restrictions on its use, such as a limit on the number of months it is applicable or on which mothers can use them.[18] Based on these exemptions, we categorize states as either not requiring work from a

[16] We obtained these data from the Urban Institute website (www.urban.org) during January 2003.
[17] We obtained these data from the SPDP website (www.spdp.org) during September 2001. In results not reported here, we re-estimated all of the models presented in the chapter using the SPDP data for hour requirements and the results are quantitatively unchanged. For example, we report in a later section that the breastfeeding rate would have been 5.5 percent higher if it were not for welfare reform. Relying on the SPDP hours data instead of the WRD hours data, the comparable number is 5.6 percent.
[18] For example, several states do not allow exemptions to apply to "capped" children, i.e., children born or conceived while the mother was already on welfare. In addition, some states based exemption criteria on the mother's characteristics (e.g., age and education). See Rowe (2000) and the Welfare Rules Database.

mother with a six-month old infant or requiring at least some work from a mother of a six-month old infant.[19]

Previous research suggests that breastfeeding declines substantially only when women work full time (see Section 3.2). Therefore, the second dimension of welfare policy is the minimum number of hours a state requires a new mother to work. In 2000, 43 states and the District of Columbia require that single-parent welfare participants work a minimum number of hours per week. We categorize states into three exhaustive categories: no hour requirements (0), moderate hour requirements (18-30), and high hour requirements (32 or more). No states have hour requirements of 1-17 or 31.

The third and final component is the sanction policy a state adopted. Sanction policy refers to the penalties that are imposed on families that do not meet the work requirements. "Full-family" sanctions withhold the entire family's cash assistance, while "partial-family" sanctions only withhold a portion of the family's benefits. Some states impose sanctions after the first offense while others only penalize after repeated offenses. We examine sanction policies because they indicate the consequences that a person would face if she does not meet the specified work requirements. Experimental evidence suggests that a stringent work requirement policy will have less of an impact when there are few consequences to violating the policy (Hamilton et al. 2001). We classify states as having a "sanction" if the state imposes a full-family sanction for the first or later violations; otherwise, a state is classified as having "no sanction."

Based on these three work policies, we classify states into eight categories.[20] Table 3.2

[19] Given this classification, it is possible that a sufficiently long exemption for new welfare entrants could keep a mother with a young child from having to work, despite there not being a young-child work exemption in the state. However, no state has implemented a long initial exemption in conjunction with a short child exemption; thus, such concerns are not empirically relevant.

[20] We attempted to separate states that would always require a mother to work versus those that sometimes require a mother to work. The results (not reported here) proved to be very noisy, which is not surprising given that we had 14 policy categories rather than the current eight policy categories.

summarizes the policy categories and Table 3.3 presents the variation in policies across time; detailed policy information for each state is available from the authors upon request. A state with a given policy in place for more than half of the calendar year is coded to have a policy indicator equal to one, otherwise the policy indicator variable takes the value zero.

Turning to Table 3.3, none of the states required work for young mothers nor did they have sanction policies in the early 1990s. A few states adopted sanction policies as a waiver during 1994 to 1996, and these states are categorized as "no work/-/sanctions." States did not begin to adopt work requirements for mothers with infants until 1996.

Although our primary interest is the effects of welfare work requirements, we also include two other measures of welfare generosity: the maximum level of cash assistance for a family of three and whether a lifetime termination time limit is in effect. These data were taken from CEA (1999) and updated through 2000 using the WRD.

***Other Data***

Two significant laws affecting breastfeeding were passed in some states during the 1990s.[21] The first law reinforces that mothers are permitted to breastfeed in public areas. The second law attempts to accommodate breastfeeding in the workplace. The stipulations of the workplace law vary among states, from acknowledging the importance of employers to allow their employees to breastfeed at work, to requiring employers to allow mothers to breastfeed at work and make appropriate accommodations for them. We rely on two indicator variables to capture the existence of these two laws, with the respective indicator taking the value of one if the policy is in effect in the state in a given year and zero otherwise. The prevalence of these laws across years is also presented in Table 3.3.

[21] We obtained these data from the La Leche League website (www.lalecheleague.org) during September 2001.

We use the state unemployment rate from the Bureau of Labor Statistics to measure local labor market opportunities. The numbers of live births by state and year, which are used as weights in the regression analysis, are taken from the National Center for Health Statistics' *National Vital Statistics Reports*.[22]

## 3.4. ANALYTICAL APPROACH

To identify the impact of the changes in welfare law on breastfeeding, we rely on a "difference-in-difference" strategy in which we exploit both the time and state variation in the data. Specifically, we compare the change in breastfeeding rates in states that adopted the various combinations of policies. Such a strategy flexibly controls for any initial differences and common time trend in breastfeeding across all states, while allowing us to focus on the direct impact of work requirement changes.

### *Graphical Analysis*

To demonstrate our basic analytic strategy, we classify states by their 2000 policy category and then pool the 28 states that are in the two relatively stringent policy categories ("work/high hours/sanctions" and "work/moderate hours/sanctions") and the five states that are in the two relatively weak policy categories ("no work/-/no sanctions" and "no work/-/sanctions"). For these pooled policy categories, we compute the prevalence of breastfeeding for WIC mothers in the years before and after the implementation of the states' policies. For example, we can obtain the prevalence in breastfeeding for each of the two groups in each of the

[22] We obtained these data from the National Center for Health Statistics website (www.cdc.gov/nchs/births.htm) during November 2001.

years before the law was passed (denoted as years -3, -2, and –1), the year the law was changed (denoted as year 0), and the years after the law was passed (denoted as years +1, +2, and +3).[23]

Figures 3.1 and 3.2 present the prevalence of breastfeeding in the hospital and six months after birth, respectively. As can be observed in Figure 3.1, there exist distinct differences between the two groups of states in their initial prevalence of breastfeeding in the hospital, but both sets of states exhibit the same general time trend. The absolute gap between the two groups remains approximately constant at 16 to 17 percentage points. A difference-in-difference strategy compares the differences in the later years to the differences in the early years to obtain an estimate of the impact of the policies. Such a comparison implies that welfare policies had little impact on breastfeeding in the hospital, which is consistent with there being no anticipatory effects.

Turning to the results for breastfeeding at six months (Figure 3.2), the results look much different. The states that adopted a stringent work policy did not experience the increase in breastfeeding that was enjoyed by those states that did not adopt a strict policy. A difference-in-different estimate would suggest the policy caused the gap to grow by roughly 3 percentage points (i.e., evaluated at the average of the three years before versus after reform).

***Regression Analysis***

We extend this basic difference-in-difference approach using a regression analysis. The extension will allow us to include other time-varying factors that may influence the breastfeeding

[23] The three states that remained in the "no work/-/no sanctions" category do not have a date of implementation since their policy did not change during the period. For these states a "date of implementation" is assigned by randomly selecting (with equal probability) one of the 28 states in the "stringent policy" category to provide an implementation date. In addition, one of the states in the stringent policy category (Wisconsin) adopted its policy in 1998, and thus the breastfeeding prevalence three years after the policy is not observed in our data; we simply compute the prevalence among the observed states for this entry. When we produce the same figure (not shown here) but exclude Wisconsin from every year, the figure is essentially unchanged.

rate and pool the various years and policy choices across states. Specifically, consider the following regression model,

$$Y_{st} = \alpha + \beta_1 Policy_{st} + \beta_2 X_{st} + \gamma_s + \lambda_t + \varepsilon_{st} \qquad (4)$$

The dependent variable $Y_{st}$ is the proportion of new mothers that breastfeed in state s in year t and $Policy_{st}$ is a vector of the seven policy indicators described in Table 3.2, with the "no work/-/no sanctions" category being the excluded group. Importantly, the basic model also includes state and year fixed effects to mimic the difference-in-difference approach described with the graphical analysis. The state fixed effects ($\gamma_s$) control for factors that are fixed within a state over time such as the racial/ethnic, education, and income distributions of a state. The year fixed effects ($\lambda_t$) capture the effects of factors that are common across all states but change over time, such as information regarding the benefits of breastfeeding. Thus, the coefficient $B_1$ represents the difference in the breastfeeding rate for mothers who live in states that implemented the given policies relative to mothers who live in states that retained the "no work/-/no sanctions" category. Implicitly, this formulation measures the mean impact of the policy change during the years following the change.

We estimate the basic model both with and without a series of controls ($X_{st}$) to capture other factors that could potentially confound the results. Two of the control variables capture other aspects of welfare policy: an indicator that takes the value of one in states/years that a lifetime termination time limit is in effect and the (log of the) maximum cash benefit for a family of three. The inclusion of these factors is intended to capture the general character of welfare policy in a state, and thus ensure that the work-requirement variables are actually capturing the effects of the work requirement policies. We also include two indicator variables for whether the two major breastfeeding laws were in effect in the state in the given year. Finally, we include the

state unemployment rate to capture cyclical changes in economic opportunities that may affect employment and, in turn, breastfeeding.

The analysis is conducted on two populations: all new mothers and new mothers who participate in WIC. We present results for all new mothers because they will provide population-level estimates that will be useful in assessing the total impact of the welfare law changes. Because many new mothers might not be affected by welfare policies, such estimates could hide large impacts on certain subgroups. Therefore, we also present results for new mothers who participate in WIC. WIC participants provide a useful sub-population that may be particularly affected by TANF policies because they are almost all low-income families. New WIC mothers must meet income and nutritional risk requirements to be eligible. The income threshold for WIC is 185 percent of the poverty line, and throughout the 1990s all AFDC/TANF recipients were income eligible for WIC.[24] Therefore, WIC is restricted to individuals who are relatively poor and are likely to be influenced by AFDC and TANF program rules. A second motivation for studying the WIC population is much more practical: breastfeeding prevalence for the WIC population is the only other aggregate tabulations available from the RLMS.

There is one potential drawback to focusing on WIC participants as a study population. WIC participation is a choice, and changes in who chooses to participate in WIC could potentially confound these results.[25] For example, if states that adopted relatively stringent work requirements also changed their WIC policies in a manner that affects who chooses to participate in WIC, then we would mistakenly attribute the change in who chooses to participate in WIC to

[24] An exception to the 185 percent cut-off is that Medicaid recipients are adjunctively eligible for WIC, and some states have Medicaid cut-offs that are above 185 percent of the poverty line.

[25] Several studies examine whether WIC rules affect breastfeeding behavior directly. To the extent any such effects are constant over time, then our difference-in-difference estimation strategy should still identify the true impact of welfare policy changes on breastfeeding. There were WIC policy changes that were intended to directly change the impact of WIC on breastfeeding behavior; however, these WIC policies were enacted before 1994 and thus should not be correlated with the welfare policy changes we analyze. See Chatterji et al. (2002) and the cites therein about the various WIC policy changes.

being a welfare policy effect on breastfeeding. However, we believe such concerns to be relatively minor. First, as was observed in the graphical analysis, a comparison of in-hospital breastfeeding rates between the two groups of states suggests that the states experienced the same underlying trends. Second, we can compare the results for WIC mothers to all mothers as a further empirical check of whether the WIC results are driven by changes in participation; these comparisons (reported in the next section) suggest that changing participation is not driving our results.

We note three final aspects about our regression analysis. First, we examine the impact of welfare reform on breastfeeding at two points after birth: in the hospital and when the infant is six months old. Again, based on previous research and the graphical analysis, we expect there to be little effect of the policies on breastfeeding in the hospital, indicating that anticipatory responses to the policies are small. Second, we weight all of our regressions (by the number of live births) because the RLMS survey sampled across states with equal probability, and thus the precision of the breastfeeding estimates varies by state.[26] Third, we report standard errors for all models that allow for an arbitrary correlation matrix within states (the so-called Huber-White sandwich estimator) because of changing sample size over time and the possibility of serially correlated errors within states.

### 3.5. REGRESSION RESULTS

The regression results for WIC participants are reported in Table 3.4. We begin with the models of breastfeeding in the hospital, which are reported in columns [1] and [2]; the models are identical except for the fact that model [2] is augmented with the control variables discussed in the previous section. Recall that we expect the policies to affect breastfeeding in the hospital

[26] Alan Ryan graciously provided the sample sizes by state for 1999, and from these data, it appears that the survey is based on a simple probability sample. However, because sample sizes were not available for all years, we could not use this information directly.

only if there are anticipatory effects. We find no support for there being anticipatory effects for the stringent welfare policies. Model [2] suggests a puzzling result in that one policy variable has a positive and significant coefficient ("work/moderate hours/no sanctions"). This finding is hard to explain in the context of our conceptual framework and suggests that there might be an important omitted factor in our analysis. However, this estimate is small relative to the rate of breastfeeding in the hospital (see the dependent variable mean in the table). We will return to the possibility that there might be an important omitted factor in the next section.

Turning to the analyses of breastfeeding six months after birth, the coefficients tell a consistent story and imply large impacts of work-related welfare requirements. Concentrating on the model that includes the controls (column [4]), the policy coefficient that implies the largest effect is the one for the most stringent work requirements ("work/high hours/sanctions"). This coefficient implies that stringent work requirements reduce the breastfeeding prevalence by 3.1 percentage points relative to the status quo of "no work/-/no sanctions." Given that the overall breastfeeding prevalence is 14.0 percent among WIC mothers six months after birth, this represents a reduction of approximately 22 percent. The two policies that have the next largest effects are the policies that require work and are enforced by sanctions: "work/moderate hours/sanctions" has a coefficient of –0.028 and "work/no hours/sanctions" has a coefficient of –0.023.[27]

The results for all mothers, presented in Table 3.5, mirror those for WIC mothers. There is no support for the claim that the anticipation of binding work requirements several months after birth impact breastfeeding rates in the hospital. For the results six months after birth, a

[27] The category "no work/-/sanctions" has a coefficient of –0.020; states that adopted these policies have an odd combination of tough sanctions policies but yet no work requirement for mothers with children six months old. Although 13 states implemented these policies at some point during the 1990s, only two states still had the policies in effect in 2000. Therefore, virtually all states implemented these policies for a short period of time. These complexities make it difficult to interpret the effects of this policy category.

consistent story emerges again. The policy coefficients imply that there is a large and significant reduction of breastfeeding in states that adopt the most stringent welfare policy; the decline in states adopting the "work/high hours/sanctions" policies is 2.1 percentage points and the decline in states adopting the "work/moderate hours/sanctions" policies is 1.7 percentage points.

When interpreting these magnitudes, it is important to note that breastfeeding is much more common among all new mothers than among WIC mothers, with rates of 23 percent and 14 percent six months after birth, respectively. Therefore, although the effects of strong work policies are only 1.0 percentage points higher for WIC mothers (3.1 percentage points) than all mothers (2.1 percentage points), this translates into a much larger percent change among WIC mothers: 22 percent (3.1/14.0) versus 9 percent (2.1/23.0).

The relative size of the effects for WIC mothers versus all mothers is consistent with their representation in the population. Specifically, we estimate that the effect of adopting the most stringent welfare policy amounts to a reduction in breastfeeding by 3.1 percentage points among WIC mothers (column [4] from Table 3.4), and suppose we assume that the effect of the policy is zero among non-WIC mothers.[28] Analysis of the RLMS shows that roughly 45 percent of all new mothers are enrolled in WIC. Therefore, we would expect to find the effect among all new mothers to be roughly 45 percent of the size of the effect among WIC mothers. We find that the ratio of estimated effects is somewhat larger at 68 percent (i.e., -0.021 relative to -0.031).

***Sensitivity Analysis***

As a check of the robustness of our results, we estimate an additional specification that controls much more flexibly for differences across states. In particular, the fixed-effects specification estimated thus far effectively controls for any factors that are constant over time

[28] We cannot test this hypothesis because estimates of breastfeeding among mothers who are not enrolled in WIC are not available.

within a state and any factors that change systematically over time across all states. However, suppose that there were state-specific temporal changes that were correlated with the law changes. For example, it is possible that states that increasingly placed greater emphasis on breastfeeding or passed WIC polices to encourage breastfeeding also adopted less-stringent welfare reforms. Any such changes would confound our estimation strategy given that we account only for fixed state and year effects.

To control more generally for secular changes within states, we estimate models that include the breastfeeding rate in the hospital as a control in regressions that use the six-month breastfeeding rate as the dependent variable. We interpret the inclusion of the in-hospital rate as controlling for any state-specific factors that generally affect the propensity of mothers to begin to breastfeed; this would include other policy changes and public health initiatives, for example. Thus, such a strategy provides for a significantly more flexible control for state-specific secular changes. However, such a strategy necessarily ignores any effects of the work policies on breastfeeding in the hospital (i.e., anticipatory effects), but our estimates in Table 3.4 and 3.5 imply that these effects are small.

We present these estimates for WIC mothers in column [5] in Table 3.4 and for all mothers in column [5] in Table 3.5. In both models the effects of policy are essentially unchanged, and our basic finding still holds: stringent work requirements for new mothers reduce the prevalence of breastfeeding.

***How Much Lower Were National Breastfeeding Rates Because of Welfare Reform?***

The central question of interest is the extent to which welfare reform caused reductions in breastfeeding. To provide a comprehensive answer to this question, we use the estimates of the effects of welfare work policies for all mothers six months after birth and compute what the

breastfeeding prevalence would have been if the welfare work requirements were not adopted. The change in breastfeeding caused by the change in policy between 1995 (before PRWORA) and 2000 (the most recent year of available data) is calculated as,

$$\Delta_{policy} = \beta_1 (Policy_{'00} - Policy_{'95}) \quad (5)$$

The estimates of $B_1$ are reported in column [5] of Table 3.5. $Policy_t$ is a vector of the proportion of live births in year t that are born under each of the policy regimes; these proportions were reported in the bottom panel of Table 3.3.

Equation [5] implies that the national breastfeeding rate six months after birth is 1.2 percentage points lower in 2000 than it would have been if PRWORA welfare work policies for new mothers had not been implemented. Prior to reforms in 1996, 21.6 percent of mothers breastfed when their child was six months old (Table 3.1). Therefore, welfare reform caused breastfeeding to decline by 5.5 percent.

Although the measured effect is moderate from an aggregate perspective, it implies that the policy impact is sizeable, but plausible, among those mothers likely to be effected by the change. Sixty percent of live births in 2000 were in states that had adopted work requirements with strict sanctions (Table 3.3, last row). Forty-six percent of infants in these states are enrolled in WIC,[29] and just prior to reform, roughly 13 percent of new WIC mothers breastfed six months after birth (Table 3.1). Using the 2000 Current Population Survey Food Security Supplement, we estimate that 73.5 percent of WIC female participants with a child under one do not work full time (i.e., at least 35 hours per week). Therefore, the share of live births in the nation at risk of

[29] We calculated WIC participation among infants in states with full-family sanction policies using estimates of the number of live births from the *National Vital Statistics Reports* (downloaded from the NCHS website, www.cdc.gov/nchs/births.htm, in August 2002) and number of infants participating in WIC (Bartlett et al. 2002) in each state in 2000.

being affected by the policy change is roughly 2.64 percent (i.e., 0.60 x 0.46 x 0.13 x 0.735).[30] With an estimated effect of 1.2 percentage points, this means that among new mothers who were breastfeeding, not working full time, and were living in the states that adopted the strict sanction policies, roughly half (1.2/2.64) of them changed their breastfeeding practices because of the policies.

### 3.6. DISCUSSION AND CONCLUSION

Previous research has suggested that employment can negatively impact the breastfeeding rate of women with infants. We examine whether the recent welfare reforms that require work among women with infants have affected the prevalence of breastfeeding. We find that these work requirements substantially and statistically significantly reduce breastfeeding. Our preferred estimates imply that for women on WIC, which is a group of new mothers that is at substantial risk of entering welfare, the most stringent laws reduce breastfeeding by 22 percent relative to imposing no work requirements on new mothers. The second most stringent laws reduce breastfeeding by about 20 percent relative to imposing no work requirements. The estimates for all mothers, not just those participating in WIC, imply that if welfare reform had not been adopted, national breastfeeding rates six months after birth would have been 5.5 percent higher than they are today.

These findings are particularly important given the substantial evidence documenting the benefits of breastfeeding for children and their mothers. However, the costs of the decrease in breastfeeding accrue not only to recipients and their children but also to society as a whole. Recent studies have shown that breastfeeding decreases health care costs as well as increases the productivity of working mothers through decreases in absenteeism at work (Montgomery and

[30] This calculation assumes that the proportion working full time does not differ between breastfeeding and non-breastfeeding women. If we assume that this difference is maximal, i.e., that 100 percent of breastfeeding women do not work full time, then the proportion at risk is slightly higher at 3.59 (0.60 x 0.46 x 0.13 x 1.0).

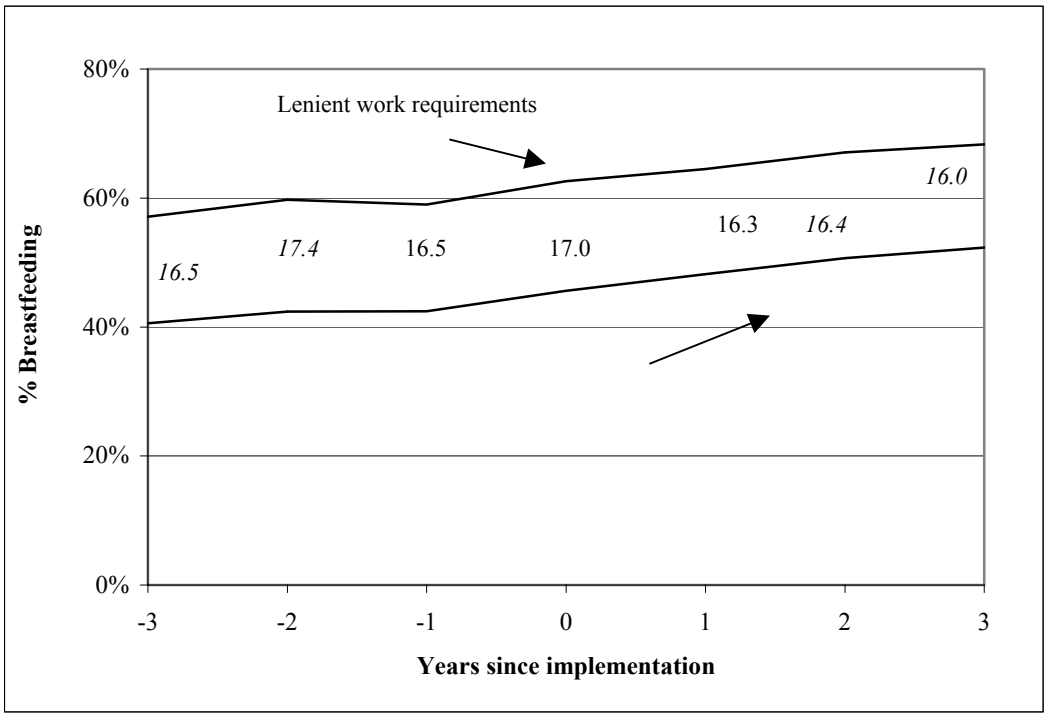
Splett 1997; Tuttle and Dewey 1996). Because the women who are most at risk of being adversely affected by these policies are poor, it is possible that a greater financial burden will be placed on Medicaid.

There is political and popular support for policies that encourage welfare recipients to work, and these policies have been applied to mothers whose children are just a few months old. Our results suggest that these policies could impose a significant cost on infants and their mothers by reducing the prevalence of breastfeeding. This cost must be weighed against the potential benefits associated with the rise in employment. However, the vast majority of the harmful effects on breastfeeding would be eliminated if mothers of infants did not face the combined policies of (full-family) sanctions and work requirements of more than 18 hours per week, requirements that are currently in place in 28 states.

## FIGURES AND TABLES

### Figure 3.1. Breastfeeding Rate for New WIC Mothers in the Hospital by Broad Welfare Policy Category

***(Difference Between Groups in Each Year Reported in Italics)***

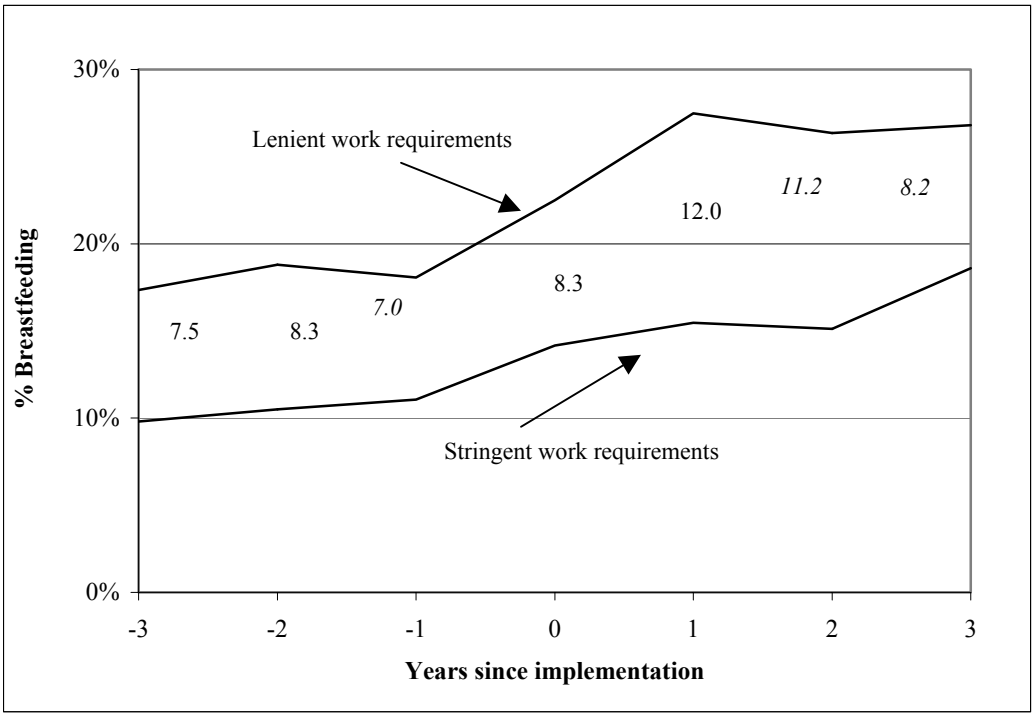



Notes: Tabulations are based on state-level prevalence rates from the RLMS. Prevalence rates are weighted by number of live births in the given state/year. States are classified with respect to their policy regime in 2000. Lenient work requirement states are states whose 2000 policy places them in the "no work/-/no sanctions" or "no work/-/sanctions" category in Table 3.2. Stringent work requirement states are states whose 2000 policy places them in either the "work/high hours/sanctions" or "work/moderate hours/sanctions" categories.

Stringent work requirements

**Figure 3.2. Breastfeeding Rate for New WIC Mothers at Six Months by Broad Welfare Policy Category**

***(Difference Between Groups in Each Year Reported in Italics)***




Notes*:* Tabulations are based on state-level prevalence rates from the RLMS. Prevalence rates are weighted by number of live births in the given state/year. States are classified with respect to their policy regime in 2000. Lenient work requirement states are states whose 2000 policy places them in the "no work/-/no sanctions" or "no work/-/sanctions" category in Table 3.2. Stringent work requirement states are states whose 2000 policy places them in either the "work/high hours/sanctions" or "work/moderate hours/sanctions" categories.

**Table 3.1. Breastfeeding Prevalence, by Year and Category**

| | New WIC Mothers | | All New Mothers | |
|---|---|---|---|---|
| Year | In the Hospital | Six Months After Birth | In the Hospital | Six Months After Birth |
| 1990 | 0.353 | 0.086 | 0.518 | 0.178 |
| 1991 | 0.385 | 0.095 | 0.536 | 0.183 |
| 1992 | 0.403 | 0.106 | 0.545 | 0.190 |
| 1993 | 0.431 | 0.114 | 0.562 | 0.191 |
| 1994 | 0.456 | 0.122 | 0.576 | 0.198 |
| 1995 | 0.477 | 0.131 | 0.597 | 0.216 |
| 1996 | 0.475 | 0.133 | 0.592 | 0.216 |
| 1997 | 0.511 | 0.170 | 0.623 | 0.259 |
| 1998 | 0.531 | 0.189 | 0.642 | 0.285 |
| 1999 | 0.565 | 0.198 | 0.671 | 0.306 |
| 2000 | 0.573 | 0.203 | 0.683 | 0.313 |

Note: These tabulations are based on state-level aggregate breastfeeding rates, weighted by the number of live births in the state/year.

**Table 3.2. Categorization of State Welfare Policies**

| Category (Most Stringent to Least Stringent) | Welfare Policies: Any work Requirements for Mothers of 6 Month Old?[a] | Welfare Policies: Hour Requirements[b] | Welfare Policies: Full-family Sanction? |
|---|---|---|---|
| 1. Work/high hours/sanctions | Yes | 32-40 | Yes |
| 2. Work/moderate hours/sanctions | Yes | 18-30 hours | Yes |
| 3. Work/no hours/sanctions | Yes | 0 hours | Yes |
| 4. Work/high hours/no sanctions | Yes | 32-40 | No |
| 5. Work/moderate hours/no sanctions | Yes | 18-30 hours | No |
| 6. Work/no hours/no sanctions | Yes | 0 hours | No |
| 7. No work/-/sanctions | No | Not applicable | Yes |
| 8. No work/-/no sanctions | No | Not applicable | No |

[a]Work requirements for new mothers are defined as policies that require mothers to return to work within the first six months of having a child.
[b]These groups are exhaustive as no state has hour requirements of 1-17 or 31 hours.

**Table 3.3. Number of States and Proportion of Live Births by Policy Category and Year**

| | Work-related Welfare Policy Categories | | | | | | | | Passed Breastfeeding Laws | |
|---|---|---|---|---|---|---|---|---|---|---|
| Work? | Yes | Yes | Yes | Yes | Yes | Yes | No | No | | |
| Hours | High | Mod. | None | High | Mod. | None | N/A | N/A | | |
| Sanctions? | Yes | Yes | Yes | No | No | No | Yes | No | Public | Emp. |
| *Number of States* | | | | | | | | | | |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 1 | 0 |
| 1991 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 1 | 0 |
| 1992 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 1 | 0 |
| 1993 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 3 | 0 |
| 1994 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 49 | 5 | 1 |
| 1995 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 48 | 10 | 2 |
| 1996 | 0 | 0 | 2 | 0 | 0 | 2 | 8 | 39 | 10 | 2 |
| 1997 | 5 | 17 | 6 | 0 | 9 | 0 | 6 | 8 | 15 | 3 |
| 1998 | 5 | 24 | 6 | 0 | 11 | 0 | 2 | 3 | 17 | 4 |
| 1999 | 4 | 24 | 7 | 0 | 11 | 0 | 2 | 3 | 26 | 7 |
| 2000 | 4 | 24 | 7 | 0 | 11 | 0 | 2 | 3 | 26 | 7 |
| ***Proportion of Live Births*** | | | | | | | | | | |
| 1990 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.07 | 0.00 |
| 1991 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.07 | 0.00 |
| 1992 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.07 | 0.00 |
| 1993 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.14 | 0.00 |
| 1994 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.99 | 0.20 | 0.05 |
| 1995 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.95 | 0.37 | 0.12 |
| 1996 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.01 | 0.16 | 0.80 | 0.37 | 0.13 |
| 1997 | 0.08 | 0.33 | 0.11 | 0.00 | 0.17 | 0.00 | 0.04 | 0.27 | 0.56 | 0.14 |
| 1998 | 0.10 | 0.38 | 0.11 | 0.00 | 0.25 | 0.00 | 0.02 | 0.14 | 0.57 | 0.27 |
| 1999 | 0.09 | 0.38 | 0.13 | 0.00 | 0.25 | 0.00 | 0.02 | 0.14 | 0.66 | 0.33 |
| 2000 | 0.09 | 0.38 | 0.13 | 0.00 | 0.25 | 0.00 | 0.02 | 0.14 | 0.66 | 0.34 |

Note: See Table 3.2 for further details regarding the welfare policy categorizations.

**Table 3.4. Regression Models: New WIC Mothers**

| | In Hospital | | Six Months After Birth | | |
|---|---|---|---|---|---|
| Variable | [1] | [2] | [3] | [4] | [5] |
| Work req./hour req. /sanction policy | | | | | |
| Work /high hours/sanctions | -0.004 | 0.006 | -0.037** | -0.031** | -0.032** |
| | (0.015) | (0.011) | (0.016) | (0.014) | (0.013) |
| Work/moderate hours/sanctions | -0.003 | 0.007 | -0.034** | -0.028*** | -0.030*** |
| | (0.008) | (0.007) | (0.015) | (0.010) | (0.010) |
| Work/no hours/sanctions | -0.011 | 0.002 | -0.029 | -0.023 | -0.024* |
| | (0.011) | (0.011) | (0.017) | (0.014) | (0.014) |
| Work/high hours/no sanctions | - | - | - | - | - |
| | - | - | - | - | - |
| Work/moderate hours/no sanctions | 0.007 | 0.015** | -0.008 | -0.004 | -0.008 |
| | (0.007) | (0.006) | (0.017) | (0.014) | (0.014) |
| Work/no hours/no sanctions | 0.001 | 0.004 | -0.007 | -0.006 | -0.006 |
| | (0.003) | (0.004) | (0.005) | (0.005) | (0.005) |
| No work/-/sanctions | -0.017** | -0.014 | -0.020 | -0.020* | -0.016* |
| | (0.008) | (0.010) | (0.012) | (0.011) | (0.010) |
| Unemployment rate | | -0.019 | | 0.082 | 0.086 |
| | | (0.185) | | (0.288) | (0.284) |
| Maximum benefits (log) | | -0.069** | | -0.080** | -0.063* |
| | | (0.028) | | (0.038) | (0.036) |
| Time limit | | 0.003 | | 0.014* | 0.013* |
| | | (0.007) | | (0.007) | (0.008) |
| Public law | | 0.011** | | -0.001 | -0.004 |
| | | (0.005) | | (0.006) | (0.006) |
| Employment law | | 0.004 | | 0.006 | 0.005 |
| | | (0.007) | | (0.009) | (0.009) |
| In-hospital breastfeeding rate | | | | | 0.243*** |
| | | | | | (0.072) |
| Mean of dependent variable | 0.468 | 0.468 | 0.140 | 0.140 | 0.140 |
| Observations | 561 | 561 | 561 | 561 | 561 |

Notes*:* All models include state and year effects. Adjusted standard errors in parentheses.
Reference category is "no work/-/no sanctions." No state is categorized as "work/high hours/no sanctions."
* significant at 10 percent level; ** significant at 5 percent level;
*** significant at 1 percent level

**Table 3.5. Regression Models: All New Mothers**

| | In Hospital | | Six Months After Birth | | |
|---|---|---|---|---|---|
| Variable | [1] | [2] | [3] | [4] | [5] |
| Work req./hour req. /sanction policy | | | | | |
| Work /high hours/sanctions | 0.004 | 0.004 | -0.025*** | -0.021*** | -0.022*** |
| | (0.007) | (0.007) | (0.007) | (0.006) | (0.006) |
| Work/moderate hours/sanctions | 0.014*** | 0.014** | -0.022*** | -0.017*** | -0.020*** |
| | (0.005) | (0.006) | (0.007) | (0.006) | (0.006) |
| Work/no hours/sanctions | 0.002 | 0.002 | -0.020* | -0.014 | -0.014 |
| | (0.007) | (0.008) | (0.011) | (0.011) | (0.011) |
| Work/high hours/no sanctions | - | - | - | - | - |
| | - | - | - | - | - |
| Work/moderate hours/no sanctions | 0.016* | 0.016*** | -0.004 | -0.001 | -0.004 |
| | (0.006) | (0.006) | (0.007) | (0.006) | (0.006) |
| Work/no hours/no sanctions | 0.008 | 0.008 | -0.001 | 0.001 | -0.001 |
| | (0.005) | (0.005) | (0.003) | (0.003) | (0.004) |
| No work/-/sanctions | -0.003 | -0.003 | -0.015* | -0.014* | -0.013* |
| | (0.004) | (0.006) | (0.009) | (0.007) | (0.007) |
| Unemployment rate | | -0.094 | | 0.110 | 0.127 |
| | | (0.145) | | (0.161) | (0.163) |
| Maximum benefits (log) | | 0.013 | | -0.038* | -0.041* |
| | | (0.024) | | (0.022) | (0.024) |
| Time limit | | -0.004 | | 0.003 | 0.004 |
| | | (0.006) | | (0.004) | (0.005) |
| Public law | | 0.002 | | 0.005 | 0.005 |
| | | (0.004) | | (0.004) | (0.004) |
| Employment law | | -0.002 | | 0.001 | 0.001 |
| | | (0.006) | | (0.005) | (0.006) |
| In-hospital breastfeeding rate | | | | | 0.173* |
| | | | | | (0.089) |
| Mean of dependent variable | 0.594 | 0.594 | 0.230 | 0.230 | 0.230 |
| Observations | 561 | 561 | 561 | 561 | 561 |

Notes: All models include state and year effects. Adjusted standard errors in parentheses.
Reference category is "no work/-/no sanctions." No state is categorized as "work/high hours/no sanctions."
* significant at 10 percent level; ** significant at 5 percent level;
*** significant at 1 percent level

# CHAPTER 4. THE ROLE OF WORKPLACE CHARACTERISTICS IN BREASTFEEDING PRACTICES

## 4.1. 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, 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 on 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 (i.e., without supplementation). United States breastfeeding rates increased 35 percent at birth and 85 percent six months after birth between 1990 and 2001 (Ryan, Wenjun, and Acosta 2002).[31] However, in 2001, nearly one-third of mothers did not initiate breastfeeding, and only 33 percent of all mothers breastfed for six months (Ryan, Wenjun, and Acosta 2002). Further, disparities in breastfeeding rates exist, with low-income, Black, less-educated, younger, and working women being less likely to breastfeed.

This chapter focuses on the breastfeeding practices of working mothers. Working mothers comprise a large portion of new mothers, with over half (50.6 percent) of mothers with infants under 12 months of age working in 2001 (BLS 2002). In addition, the difference in breastfeeding rates between working and non-working mothers is large; mothers working full-time are 11 percentage points (30 percent) less likely to breastfeed six months after birth than

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

non-working mothers in 2001 (Ryan, Wenjun, and Acosta 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 chapter seeks to understand one underlying mechanism that may produce disparities in breastfeeding rates among working women: workplace characteristics. Specifically, data from the National Longitudinal Survey of Youth 1979 are used to estimate the effects of availability of employer-sponsored child care, availability of a flexible schedule, hours worked at home, and working a rotating schedule on the breastfeeding outcomes of working women. These workplace characteristics are frequently mentioned by breastfeeding experts as potentially effective ways to facilitate breastfeeding and work. However, their effectiveness has not been empirically tested. To increase our understanding of these relationships, this study also investigates whether workplace characteristics are endogenous to breastfeeding by examining women's job choices in relation to fertility behavior.

Estimates from recursive bivariate probit models suggest that the availability of employer-sponsored child care increases the likelihood of breastfeeding six months after birth by 59 percent. 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 a flexible schedule and working a rotating schedule do not have significant effects on breastfeeding outcomes. In addition, evidence suggests that workplace characteristics are not endogenous to breastfeeding practices.

## 4.2. BACKGROUND

### *Health Benefits of Breastfeeding*

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

children and mothers.[32] 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 (U.S.) and abroad have found evidence that children who are breastfed have lower rates of urinary and 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, and reduced menstrual blood loss.

Reflecting research that indicates that children and mothers benefit from breastfeeding, numerous organizations and public health officials recommend breastfeeding. These organizations include: American Academy of Family Physicians, American Academy of Pediatrics, American Dietetic Association, American Medical Association, and the World Health Organization. The American Academy of Pediatrics (1997) endorses exclusive breastfeeding for approximately six months after birth and recommends continued breastfeeding with supplementation until the infant is at least 12 months old. The U.S. 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" (U.S. DHHS 2000). The

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

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.[33]

***Breastfeeding and Maternal Employment***

Although the well-documented benefits of breastfeeding have been widely disseminated, all women do not breastfeed with working women less likely to breastfeed than non-working women. Figure 4.1 illustrates that working full-time and breastfeeding may be competing behaviors six months after birth, but not immediately after birth. In 2001, women working full-time six months after birth were approximately 11 percentage points (30 percent) less likely to breastfeed than women not working (Ryan, Wenjun, and Acosta 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.

Studies using multivariate regression techniques and well-known, U.S. data sources also demonstrate a negative relationship between postpartum maternal work status and breastfeeding duration; however, the evidence on the relationship between maternal employment and initiation is mixed. For example, studies by Fein and Roe (1998), Visness and Kennedy (1997), and Lindberg (1996a) find a negative association between breastfeeding duration and employment and mixed results regarding the correlation of employment and the initiation of breastfeeding. While these studies provide valuable information on the association between employment and breastfeeding, they do not address the possibility that work status is endogenous to breastfeeding. For example, women who do not want to breastfeed may decide to return to work earlier (i.e., negative selection) or mothers may have a great desire to both breastfeed and work (i.e., positive selection).

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

Two studies attempt to address the endogeneity of work status and still find negative relationships between work and breastfeeding. Roe et al. (1999) estimate a simultaneous model of maternal employment and breastfeeding using data from the Infant Feeding Practices Survey collected between 1993 and 1994. They find that the shorter the duration of work leave in weeks, the shorter the duration of breastfeeding in weeks. Their results also indicate that breastfeeding behaviors do not significantly affect employment, thus suggesting that employment decisions are determined first. Chatterji and Frick (2003) test whether returning to work within three months of birth 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.

This chapter contributes to this body of research along several dimensions. As previous studies examine the effect of working compared to not working on breastfeeding outcomes, little is known about what generates differences in breastfeeding practices among working women. This chapter 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 chapter are often cited by breastfeeding experts as potentially effective ways to facilitate breastfeeding and work (Meek 2001; U.S. DHHS 2000; Riordan and Auerbach 1998; Corbett-Dick and Bezek 1997; Barber-Madden, Petschek, and Pakter 1987; Moore and Jansa 1987). Women also mentioned these characteristics as helpful to facilitating breastfeeding and working. Results from a survey conducted by Auerbach (1984) indicate that the second biggest obstacle faced by working women trying to breastfeed was finding time at work to pump/express milk. Other obstacles mentioned include finding a place at work to pump,

extra travel to reach the baby during the workday, and the inability to pump at work. However, the effectiveness of these workplace characteristics has not been empirically tested.

To estimate the effects of workplace characteristics on breastfeeding, the chapter addresses whether workplace characteristics affect breastfeeding practices indirectly through return-to-work behavior. In other words, do workplace characteristics influence women to return to work earlier after birth? Consequently, this chapter considers how to model the effect of work status on breastfeeding decisions and empirically tests it. Finally, to further the understanding of these relationships, the chapter investigates 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.

## 4.3. DATA

The primary data source 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.[34]

### *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 original sample of 12,686 men and women 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. The NLSY79 dropped most of the Armed Forces sample in 1989 and the over-sample of low-

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

income Whites in 1993.[35] Prior to 1994, respondents were surveyed every year. After 1994, respondents were interviewed every other year (1994, 1996, 1998, 2000). The latest wave of available data was collected in 2000.[36]

Information on two aspects of breastfeeding is collected: whether the mother ever breastfed and the duration of breastfeeding.[37] The questions asked of respondents are similar to those asked in other data sources frequently used to study breastfeeding including the National Health and Examination Survey (NHANES) IV and the National Survey of Family Growth (NSFG). In the NLSY79, female respondents who recently gave birth were asked "When *biological child's name* was an infant did you breast feed him/her at all?"[38] 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?"[39]

Given that the primary motivation of the NLSY79 is to understand labor market experiences, the employment data 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 survey question on child care asked, "Does/did your employer make available to you company provided or subsidized child care?" The question about flexible schedules asked respondents, "Does/did your employer make available to you flexible hours or work schedule?" The question on hours worked at home asked, "How many hours per week (do/did) you usually

[35] Results are reported including respondents in the over-samples. Models estimated without the over-samples and with indicator variables for the over-samples produce qualitatively similar results 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.
[36] The Center for Human Resource Research (2001) provides further information on the NLSY79 sample design and survey content.
[37] NLSY79 stopped collecting data on the exclusivity of breastfeeding in 1991.
[38] Respondents with multiple births or adopted out or deceased children were asked about breastfeeding practices.
[39] Respondents answered in weeks or months. NLSY79 converted all responses to weeks assuming that there are four weeks in a month.

work at this job at home?" Finally, the question on type of schedule worked asked 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.[40]

***Analysis Sample***

The analysis sample is limited to births between 1989 and 1999. Births prior to 1989 are excluded, as information on all four workplaces is not available. Because the NLSY79 is a panel data set, this restriction limits the maternal age of mothers to between the ages of 24 and 31 in 1989. Births occurring in 2000 are dropped to ensure complete breastfeeding spells for all births.

The analysis sample is comprised of 1,482 of the 3,503 births (42.3 percent) that occurred between 1989 and 1999. Two criteria are used to select births for inclusion. First, the birth mother must have typically worked 20 hours or more per week during the sixth month prior to the birth. Employment status six months prior to birth is commonly used as a measure of a woman's labor force status and attachment before childbirth (e.g., Waldfogel (1997)). Because questions about fringe benefits (availability of a flexible schedule and employer-sponsored child care) were not administered to respondents who worked less than 20 hours per week until 1994, the sample is limited to women who typically worked 20 hours or more per week during the sixth month before birth to maintain consistency. This restriction limits the sample to women who are work-oriented. The number of births excluded based on this criterion is 1,128 of 3,503 (32.0 percent).

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. This criterion

[40] Prior to 1990, the respondent only had two possible answer choices: same/fixed shift and shift rotates.

excluded 893 of 3,503 births (25 percent).[41] The Appendix describes how missing data are handled for other variables.

From Table 4.1 key points emerge that are relevant to the analyses and the interpretation of results. First, variation exists among respondents' workplace characteristics. Approximately 10.3 percent have employer-sponsored child care available, 52.4 percent have a flexible schedule available, 15.5 percent of respondents work any hours at home, and 8.5 percent work a rotating shift. Second, 59.6 percent of the sample initiate breastfeeding and 19.5 percent are breastfeeding six months after birth.[42] These statistics illustrate that breastfeeding prevalence rates decrease after birth and reach low levels (approximately one-fifth of the sample) six months after birth.

Finally, this sample is more educated and older relative to the mean education and age for all U.S. births during the same time period. The mean age of U.S. mothers between 1988 and 1999 ranged from 26.3 to 27.1 compared to a mean age of 31.0 years in the full sample (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 9.3 percent in the full 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 30.1 percent in the full sample (NCHS 2001).

## 4.4. EMPIRICAL STRATEGY

Evaluating the true and perceived benefits and costs of breastfeeding, a new mother will decide whether to breastfeed and when to wean her child. In addition to the aforementioned health benefits of breastfeeding, another benefit of breastfeeding is the saving of formula costs.

[41] 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 U.S., and more likely to receive public assistance.

[42] The average breastfeeding rates for the analysis sample are lower than the 2001 rates for working women presented earlier. This is because the analysis sample means reflect breastfeeding rates between 1989 and 1999, when there were significant increases in breastfeeding rates.

One of the major costs of breastfeeding relative to other forms of feeding is the time the mother spends breastfeeding her child or pumping her milk. This large time cost of breastfeeding is why work and breastfeeding are often considered competing behaviors. It is hypothesized that the workplace characteristics studied in this chapter affect the time cost of work and breastfeeding; thereby, influencing a woman's probability of breastfeeding.

To test the hypothesis that selected workplace characteristics affect the time cost of work and breastfeeding, thereby influencing the likelihood that an individual decides to initiate breastfeeding and breastfeed at six months, a recursive bivariate probit model is estimated (See Greene (2000).).

I use a latent variable model to estimate the decision to breastfeed (Equation 6).

$$BF_i^* = \alpha_0 + \alpha_1 WC_i + \alpha_2 W_i + \alpha_3 X_i + \alpha_4 Y_i + \varepsilon_i \qquad (6)$$

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 $\varepsilon_i$ is a 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 $BF_i = 1$.

I use a latent variable model to estimate the decision to return to work within three or six months after birth (Equation 7).

$$W_i^* = B_0 + B_1 H_i + B_2 WC_i + B_3 X_i + B_4 Y_i + \mu_i \qquad (7)$$

In this model $W_i^*$ is the mother's latent propensity to return to work, *H* is a vector of instruments for work status, and $\mu_i$ is a 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 $W_i = 1$.

I assume the error terms in Equations 6 and 7, $\varepsilon_i$ and $\mu_i$, are joint normally distributed and the correlation between them is $\text{cov}[\varepsilon_i, \mu_i] = \rho$.

The motivation for estimating a recursive bivariate probit model is the following. Workplace characteristics may influence breastfeeding directly, but also indirectly through the speed with which a mother returns to work. One might hypothesize that mothers with favorable workplace characteristics return to work earlier than those with unfavorable characteristics and as demonstrated in Section 4.2 work has a negative effect on breastfeeding. 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 work status on breastfeeding. Also discussed in Section 4.2, it is likely that work is endogenous to breastfeeding decisions and the estimate of work biased. Therefore, estimating a single-equation probit model with work status included as an explanatory variable is not appropriate. Estimating a recursive bivariate probit model allows work to be instrumented for and included as an explanatory variable. Second, both of the outcomes are binary. In addition, the recursive bivariate probit model tests the correlation between the error terms in the two equations after controlling for the included variables; thus, providing information on whether the unobservable factors affecting work and breastfeeding decisions are related.

While the reduced-form or net effects of workplace characteristics on breastfeeding answer the policy question of what is the effect of workplace characteristics on breastfeeding, estimating the recursive bivariate probit facilitates the understanding of the pathways through which workplace characteristics influence breastfeeding. In addition, the different effects can be

decomposed if it appears that workplace characteristics do affect breastfeeding through return-to-work behavior. Finally, results generated by the recursive bivariate probit model can inform whether workplace characteristics influence women to return to work earlier after birth.

***Breastfeeding (BF)***

The two breastfeeding outcomes are indicators for whether the infant was ever breastfed and whether the infant was breastfed to six months.[43] The breastfeeding variables are specified as dichotomous because the objective is to understand how workplace characteristics affect reaching breastfeeding objectives.[44] Ever breastfed, i.e., initiation of breastfeeding, equals one if the mother breastfed for at least one week. While information is available from the initiation question to determine if a mother ever breastfed, it is not used because it is unclear what it means to start breastfeeding and not breastfeed for at least one week.[45] In addition, other studies (Chatterji and Frick 2003; Chatterji et al. 2002) have defined initiation in a similar manner. Models were estimated using both definitions of initiation and the results are similar.

The second breastfeeding outcome is whether the mother breastfed her infant for six months or longer. All observations in the analysis sample are 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.[46] Six months is chosen as an outcome of interest because, as mentioned earlier, both research and public health organizations suggest that six

[43] Both outcome variables implicitly include milk expressed and fed to the infant with a bottle.
[44] If my research objective were different, I would consider estimating a hazard model predicting the probability of weaning in each time period.
[45] It is unclear how many births this affects 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 response to the ever breastfeed question to no (Keck 1997).
[46] This was assessed by comparing the estimated coefficients of the explanatory variables of a model with initiation as the outcome and breastfeeding at six months conditional on initiation as the outcome. Because the coefficients of 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.

months of exclusive breastfeeding is ideal.

***Work Status (W) and Instruments for Work Status (H)***

Two work status variables are included in these analyses as both dependent variables and explanatory variables in the breastfeeding equations. The work status variable in the initiation of breastfeeding model is return to work within three months. This measure is used because three months is the length of unpaid leave guaranteed under the Family and Medical Leave Act (FMLA). The work status variable included in the breastfeeding at six months model is return to work within six months.

To identify the model, at least one instrument for return to work must be included in the work equation that is not in 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.[47] For an instrument to be valid it must meet two conditions 1) be a predictor 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 ($\varepsilon_i$).

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 during unpaid leave. Table 4.2 shows that 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 health insurance available. The same is true for mothers with employer-sponsored dental insurance

[47] The question on the availability of health insurance asked 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 asked "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.

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 4.4.). Both the instrumental variables are significant with the predicted sign, positive, at the 0.01 level in the model predicting return to work within six months (See Table 4.5.). Finally, for both models the null hypothesis that the estimates of the instruments are jointly equal to zero is rejected. The chi-square statistic is $\chi^2(2) = 20.79$ with a p-value $< 0.0001$ for the model with return to work within three months as the outcome. For the model with return to work within six months as the outcome, the chi-square statistic is $\chi^2(2) = 40.38$ with a p-value $< 0.0001$.

Theoretical evidence suggests 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 prenatal or postnatal care, which might include discussions about the benefits of breastfeeding. 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 effectively 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.

Given that the theoretical argument for the validity of employer-sponsored dental insurance is stronger than that for employer-sponsored health insurance, models are estimated using employer-sponsored dental insurance as the sole instrument. The results from are similar to those presented in the next section. In addition, similar to Mellor (1998) and Evans and Schwab (1995), I estimate two-stage least squares (2SLS) models to perform overidentification tests of the instruments, which cannot be estimated using a recursive bivariate probit model. I fail to reject the null hypothesis of the overidentification tests, zero correlation between the instruments and the error terms of the breastfeeding equations. The p-value of the overidentification test is 0.120 in the initiation model and 0.840 in the model examining breastfeeding at six months.

***Workplace Characteristics (WC)***

The first workplace characteristic considered 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. However, it is not likely less expensive than other forms of child care. The availability of a flexible schedule is the second characteristic considered. 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 time cost of breastfeeding and working, and is likely to increase a new mother's probability of breastfeeding.

The third variable examined is the number of hours a woman works at 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 may be 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 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 such a schedule makes it difficult to establish a breastfeeding routine.

Both hours worked at home and working a rotating schedule are choices of the mother; therefore, they are more likely to be endogenous to breastfeeding decisions than the other workplace characteristics. 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 concern with this strategy is that if women move into jobs with more workplace characteristics after birth than the effects of workplace characteristics may be underestimated. Additionally, the marginal effects of these behavioral variables do not answer the policy question of what is the effect on breastfeeding of allowing women to work at home or work a rotating schedule. To answer this question data on whether the employer maintained a policy of allowing employees to work at home or not work a rotating schedule is necessary.

Unfortunately, such information is not available in the NLSY79.

***Maternal and Birth (X), and Contextual (Y) Variables***

Maternal and contextual variables are included to represent the true or perceived benefits and costs of breastfeeding. Maternal characteristics (*X*) include age, race/ethnicity dummy variables (non-Hispanic White, non-Hispanic-Black, and Hispanic), dummy variable for born in the U.S., 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. [48] AFQT score is a measure of basic skills and is included as a proxy for the ability to process information on breastfeeding.[49] It is different from education in that education measures formal training received, while the AFQT score reflects ability. Birth characteristics capture the circumstances surrounding the birth, which may influence the disadvantages or advantages of breastfeeding and therefore a woman's decision or ability to breastfeed.[50] Birth characteristics included are low birth-weight, cesarean section (c-section) performed, first birth, and multiple birth.

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 through changing the benefits and costs of breastfeeding. Contextual variables included in the models are regional

[48] Because the survey was administered biennially starting in 1994, some maternal information for births in odd years is extracted from the 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 spouse/husband, family size, and region of residence. Descriptions of each variable and information on the measurement of each variable relative to the timing of the birth are presented in Table A.1.
[49] 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 sections contribute twice as much to the final score as the math sections.
[50] 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 do not use them in my regression models.

dummy variables, two state breastfeeding laws, state tax rates on food, and year fixed effects. Laws intended to facilitate breastfeeding were passed in some states during the 1990s (La Leche League 2001). Table A.2 provides information on these laws by state. The first law of interest clarifies that mothers are permitted to breastfeed in public areas. 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. Two indicator variables capture the existence of these laws.

State sales tax rates on food are included to capture the variation in formula prices that an individual may face depending upon the state where they reside and the year of birth.[51] 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 A.2.). 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 U.S. Surgeon General would be captured by such a variable. Because breastfeeding rates increased from 1989 to 1999, it is expected that the coefficients of the year fixed effects will be negative compared to the excluded year, 1999.

Estimates are unweighted.[52] In addition, standard errors are clustered by the mother because multiple births to mothers are included in the analysis sample and are likely to be

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

[52] Many of the characteristics used to create the NLSY79 weights are included as control variables; 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 chapter.

correlated.[53] Previous research suggests that women tend to repeat decisions to breastfeed or not breastfeed their children (DaVanzo, Starbird, and Leibowitz 1990).

**4.5. RESULTS**

Table 4.3 presents the gross relationship between each workplace characteristic and breastfeeding outcome. Those mothers with employer-sponsored child care available are 12 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. In addition, these statistics suggest 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.

The differences in breastfeeding rates between those with and without the two remaining workplace characteristics are not statistically significant; however, the direction 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 breastfeeding is positive, which is the opposite of what I predicted. These relationships are explored in greater depth later in the chapter using multivariate techniques.

Table 4.3 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

[53] 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.

home and those who do not as women who work at home are more likely to be non-Hispanic White, to have more education, and to have higher AFQT scores and are less likely to receive public assistance. In addition, women who work at home are more than twice as likely to be in a professional position, less than half as likely to be in a clerical position, and almost twice as likely to be self-employed as 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. However, one particular association is worth highlighting. Availability of a flexible schedule is strongly correlated with working a rotating schedule, as those with a flexible schedule available are approximately three times more likely to work a rotating schedule than those without one. In addition, those who work a rotating schedule are approximately 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 $< 0.0001$. 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***

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 4.4 and 4.5. 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 employer-sponsored 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).

Based on the descriptive statistics, it is not unexpected that a positive significant

relationship between hours worked at home and breastfeeding outcomes is detected. 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. Therefore each 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.[54] 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.

Results from the return-to-work equations in Tables 4.4 and 4.5 illustrate that much of the impact 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 model with return to work within three months as the outcome. 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). Additionally, the marginal effects of the workplace characteristics generated from single-equation probit models that do not control for work status (i.e., reduced-form or net effects) are quite similar to those generated by the recursive bivariate probit models (See Table A.3.).

The small magnitude of the effect of workplace characteristics on return-to-work behavior implies that the provision of workplace characteristics does not provide an incentive for

[54] This calculation assumes a linear relationship between hours worked at home and breastfeeding.

new mothers to return to work earlier or remain in the labor force.[55] Because most women who return to work do so 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***

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 marginal 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 A.4 reports that estimates from single-equation probit models of the effects of returning to work within three and six months on breastfeeding outcomes are larger (i.e., less negative) than those generated from the recursive bivariate probit models. Consistent with the larger estimates from the single-equation probit models is an estimated positive covariance between the error terms.[56] Hence, unobservable factors positively influence both returning to work and breastfeeding, which may capture women's underlying desires to both work and breastfeed. While this positive bias contradicts the common hypothesis of negative selection, it may be capturing underlying desire of work-oriented women to both work and breastfeed.

***Multivariate Analyses: Additional Findings***

Consistent with other studies, this study finds that the following variables influence breastfeeding behavior. Women with no college compared to having a college degree, who

[55] If a woman does not return to work within six months, she will spend an average of two years out of the labor force.

[56] While these measures of $\rho$ are appropriate for the models specified, one should be cautious in interpreting them. Estimating the same models without work on the right hand side of the breastfeeding equations produces very different values of $\rho$. The estimate of $\rho$ 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 $\rho$ 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).

smoke, or have low birth-weight infants are significantly less likely to breastfeed. Residing in the West in relation to residing in the Midwest and having a higher AFQT score are significantly associated with an increased likelihood of breastfeeding. Delivering a low birth-weight infant may decrease the probability of breastfeeding because initiating breastfeeding is more difficult when the mother and child are apart at birth. In addition, delivering a low birth-weight infant could also capture a mother's low investment in her infant's well-being; the same argument can also be made for a mother's smoking status.

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 experiencing much lower rates than other groups. When 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 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.[57] This is unusual given the consensus in the literature that older women are more likely to breastfeed. However, this might reflect 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 may not achieve 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

[57] 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 effect on breastfeeding when AFQT scores were excluded.

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 model and positive and insignificant in the breastfeeding at six months 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).

## 4.6. EXPLORING THE ENDOGENEITY OF WORKPLACE CHARACTERISTICS

This chapter 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 a woman's underlying propensity to breastfeed is not measurable, this exploration of the endogeneity of workplace characteristics to breastfeeding focuses on women's job selections around the time of birth.

While workplace characteristics are measured prior to birth to reduce the likelihood that workplace characteristics are endogenous to breastfeeding, it is still possible that workplace characteristics are endogenous as women may select jobs with characteristics facilitating breastfeeding years prior to birth. However, Avertt and Whittington (2001) did not find 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 into jobs based on fertility desires, it is likely that women do not select jobs based on breastfeeding preferences. Because maternity leave policies may differ from the workplace characteristics focused on in this chapter as they are stipulated by FMLA, I perform several exercises to assess whether women select jobs with characteristics that promote breastfeeding prior to birth.[58]

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 probability that a mother has employer-sponsored child care available, flexible schedule available, or works a rotating schedule hours or the number of hours worked at home, the marginal effects of the fertility variables would be 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. 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 probit models with employer-sponsored child care, availability of flexible schedules, and work a rotating schedule as the dependent variables and ordinary least squares

[58] One 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, and percent of state employment in government jobs, retail jobs, professional jobs, and 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. Upon estimating this model, it became apparent that sufficient variation in workplace characteristics and breastfeeding practices within families over time to generate meaningful estimates of workplace characteristics does not exist in this sample.

(OLS) models with hours worked at home as the dependent variable. 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: (1) number of children considered ideal for a family; (2) the number of desired children; (3) whether one desires more children; (4) number of siblings the mother has, which can be viewed as a proxy for fertility desires; and (5) the mother's views about gender roles.[59]

Table 4.6 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 of the number of children considered ideal is statistically significant. A stronger version of this test is also performed, limiting the sample to women who changed jobs in the past three years. The results, available from the author, are similar. Overall, the findings 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.

The second exercise investigates whether women change jobs prior to birth and if they select jobs based on their workplace characteristics. 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. To test whether women are systematically selecting jobs prior to

[59] The question asked 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."

giving birth based on their workplace characteristics, I regress the number of years prior to birth that a mother began her current job (years prior to birth started job) on each workplace characteristic. The expected sign of years prior to birth started job 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 the coefficient of years prior to birth started job 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 4.7 presents the results of the coefficients of the variables of interest from this exercise. None of the coefficients of years prior to birth started job 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 find that it is not. One explanation for why there is no effect of years prior to birth started job on workplace characteristics may be 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 previous exercise substituting planned pregnancy for years started job before birth.[60] Table 4.7 shows the results for the exercise. 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 to select their jobs based on other characteristics more important to them such as availability of 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.

## 4.7. DISCUSSION AND CONCLUSION

This chapter seeks to understand the role of one potential mechanism that may affect breastfeeding practices among working women: workplace characteristics. Specifically, the effect of availability of employer-sponsored child care, availability of flexible schedules, hours

[60] The sequence of questions used to assess whether the pregnancy was planned asked whether any contraception methods were used to prevent the pregnancy prior to conception. If no methods were used, the respondent was asked if this was because she wanted to become pregnant. The final question in the sequence asked the respondent if she wanted to become pregnant. The respondent could answer: "yes," "didn't matter," "no—not right now," and "no—no more kids at all." I code those births whose parents were not using contraception with the intent to conceive and wanted the child as a planned birth and all other births as unplanned births.

worked at home, and working a rotating schedule on two breastfeeding outcomes is estimated using the National Longitudinal Survey of Youth 1979. Estimates from recursive bivariate probit models indicate that the availability of employer-sponsored child care increases the likelihood of breastfeeding six months after birth by approximately 59 percent. Working an additional eight 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 a flexible schedule and working a rotating schedule do not have significant effects on breastfeeding outcomes.

To further the understanding of these relationships, 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 chapter investigates women's job choices in relation to fertility and finds little evidence suggesting that workplace characteristics are endogenous to breastfeeding.

To get a sense of the relative magnitudes of the effect sizes of the workplace characteristics, I compare the effects of workplace characteristics with findings from other interventions. Outreach efforts including phone calls and home visits from health professionals, informational packages, and medical office visits have had mixed success increasing breastfeeding rates. Table 4.8 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.

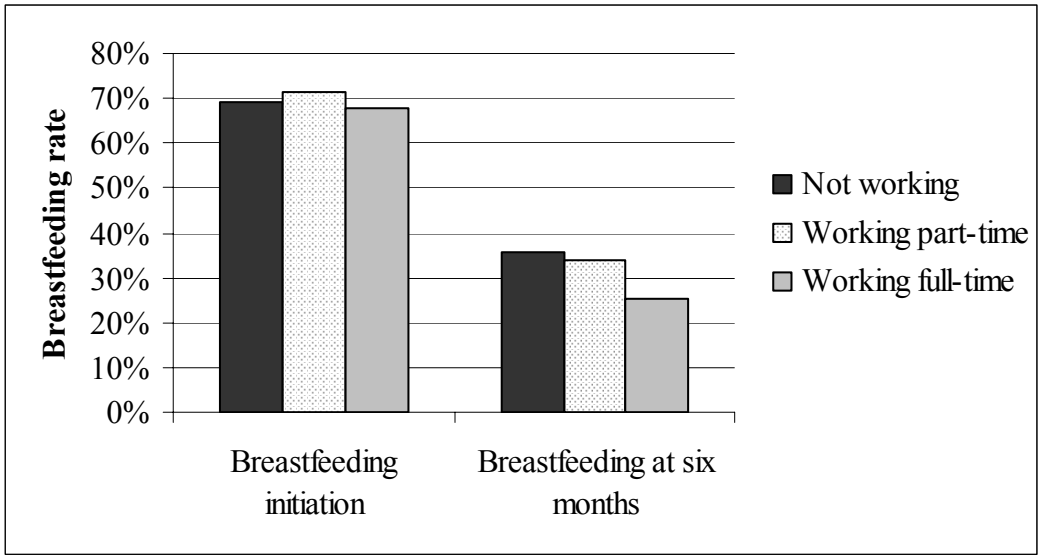
Given that the success of currently used interventions is mixed and the effect sizes of workplace characteristics are comparable to those from successful interventions, workplace characteristics show promise of being an effective way to increase breastfeeding rates among working women and warrant additional study. While some data on workplace characteristics are collected in the NLSY79, information on additional workplace characteristics would have benefited this study. Relevant additional workplace characteristics might include: availability of a lactation room, office with a door, and employer policies regarding job-sharing, working at home, working a rotating shift, and the frequency and duration of breaks.

This chapter only considers one component of a benefit-cost analysis of changing workplace characteristics to promote breastfeeding: the impact of workplace characteristics on breastfeeding outcomes. To perform a complete benefit-cost analysis, information on the additional benefits of workplace characteristics, the costs associated with workplace characteristics, and the feasibility of their implementation would be necessary. For example, consider some of the benefits and costs of employer-sponsored child care from the prospective of the employer. As demonstrated in this study employer-sponsored child care increases breastfeeding rates. In addition, a study by Cohen, Mtrek, and Mtrek (1995) suggests an association between breastfeeding and decreased maternal absenteeism. Employer-sponsored child care is also associated with improved retention and recruitment of employees, morale, and productivity (Simmons GSM Marketing Team 1997). Other benefits of employer-sponsored child care may include increased prestige for the organization. However, there are costs of

providing such care to the firm. For example, firms typically subsidize some fraction of the operating costs, which can range between $7,500 and $12,000 per child per year (McIntyre 2000). This information would then be compared with the benefits and costs of alternative interventions such as informational campaigns or visits or phone calls from lactation consultants.

## FIGURES AND TABLES

**Figure 4.1. Breastfeeding Initiation and at Six Months by Work Status, 2001**




Source: Ryan, Wenjun, and Acosta 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.

**Table 4.1. 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* | | |
| Child care available | 0.103 | 0.303 |
| Flexible schedule available | 0.524 | 0.500 |
| Hours work at home | 1.48 | 5.79 |
| 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 U.S. | 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 4.2. 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* |

Notes: The sample size is 1,482. The correlation between employer-sponsored health insurance and employer-sponsored dental insurance is 0.56 with a p-value < 0.0001.
* Difference between means is statistically significant at the 5 percent level using a two-tailed test.

**Table 4.3. Mean of Selected Variables by Workplace Characteristic Status**

| | Child care available? | | Flexible schedule available? | | Work any hours at home? | | Work a rotating schedule? | |
|---|---|---|---|---|---|---|---|---|
| | *Yes* | *No* | *Yes* | *No* | *Yes* | *No* | *Yes* | *No* |
| *Breastfeeding outcomes* | | | | | | | | |
| Initiate breastfeeding | 0.664 | 0.588 | 0.606 | 0.585 | 0.751* | 0.567 | 0.635 | 0.592 |
| Breastfeed to 6 months | 0.303* | 0.183 | 0.184 | 0.207 | 0.305* | 0.175 | 0.206 | 0.194 |
| *Workplace characteristics* | | | | | | | | |
| Child care available | - | - | 0.155* | 0.045 | 0.094 | 0.104 | 0.095 | 0.103 |
| Flexible schedule available | 0.789* | 0.493 | - | - | 0.481 | 0.532 | 0.738* | 0.504 |
| Work any hours at home | 0.145 | 0.159 | 0.144 | 0.171 | - | - | 0.214 | 0.152 |
| Work rotating schedule | 0.079 | 0.086 | 0.120* | 0.047 | 0.116 | 0.079 | - | - |
| *Work status* | | | | | | | | |
| Return to work within 3 months | 0.697 | 0.735 | 0.724 | 0.739 | 0.790* | 0.721 | 0.690 | 0.735 |
| Return to work within 6 months | 0.901 | 0.871 | 0.880 | 0.868 | 0.910 | 0.868 | 0.841 | 0.878 |
| *Maternal characteristics* | | | | | | | | |
| Age | 31.88 | 31.35 | 31.54 | 31.25 | 32.00* | 31.29 | 31.96 | 31.35 |
| Non-Hispanic White | 0.533 | 0.571 | 0.566 | 0.569 | 0.700* | 0.543 | 0.635 | 0.561 |
| Non-Hispanic Black | 0.243 | 0.237 | 0.242 | 0.232 | 0.155* | 0.253 | 0.190 | 0.242 |
| Hispanic | 0.224 | 0.192 | 0.192 | 0.198 | 0.146* | 0.204 | 0.175 | 0.197 |
| Born in the U.S. | 0.875* | 0.935 | 0.930 | 0.928 | 0.936 | 0.928 | 0.960 | 0.926 |
| Education | 14.26* | 13.67 | 13.75 | 13.71 | 15.61* | 13.38 | 13.76 | 13.73 |
| AFQT score | 46.42 | 45.41 | 45.00 | 46.08 | 61.19* | 42.59 | 44.61 | 45.60 |
| Receive any public assistance | 0.289 | 0.300 | 0.300 | 0.297 | 0.220* | 0.313 | 0.286 | 0.300 |
| *Birth characteristics* | | | | | | | | |
| C-section performed | 0.237 | 0.250 | 0.254 | 0.244 | 0.202 | 0.258 | 0.238 | 0.250 |
| First birth | 0.296 | 0.362 | 0.344 | 0.368 | 0.361 | 0.355 | 0.317 | 0.359 |
| *Contextual variables* | | | | | | | | |
| Reside in the Northeast | 0.164 | 0.174 | 0.182 | 0.164 | 0.155 | 0.177 | 0.183 | 0.173 |
| Reside in the South | 0.349 | 0.402 | 0.352* | 0.446 | 0.438 | 0.389 | 0.349 | 0.401 |
| Reside in the West | 0.217 | 0.185 | 0.211* | 0.163 | 0.197 | 0.187 | 0.183 | 0.189 |
| Reside in the Midwest | 0.270 | 0.238 | 0.255 | 0.227 | 0.210 | 0.247 | 0.286 | 0.237 |
| Public breastfeeding law | 0.270* | 0.199 | 0.219 | 0.193 | 0.206 | 0.207 | 0.238 | 0.204 |
| Employment breastfeeding law | 0.092 | 0.070 | 0.070 | 0.075 | 0.077 | 0.071 | 0.063 | 0.073 |
| Year fixed effects | 1993.76* | 1993.06 | 1993.25 | 1993.01 | 1993.56* | 1993.06 | 1993.86* | 1993.07 |
| *Job characteristics* | | | | | | | | |
| Government organization | 0.500 | 0.431 | 0.436 | 0.440 | 0.410 | 0.444 | 0.550* | 0.428 |
| Private organization | 0.386 | 0.484 | 0.464 | 0.483 | 0.438 | 0.480 | 0.303* | 0.489 |
| Self-employed | 0.100 | 0.060 | 0.075 | 0.051 | 0.095* | 0.058 | 0.073 | 0.063 |
| Professional job | 0.353 | 0.280 | 0.269 | 0.308 | 0.546* | 0.239 | 0.254 | 0.291 |
| Clerical job | 0.333 | 0.322 | 0.335 | 0.311 | 0.127* | 0.361 | 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 4.4. Recursive 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* | | | | | | |
| Child care available | 0.046 | 0.155 | 0.017 | -0.208 | 0.117 | -0.070 |
| Flexible schedule available | 0.050 | 0.076 | 0.019 | -0.021 | 0.080 | -0.007 |
| Hours work at home | 0.018 | 0.008 | 0.007* | 0.023 | 0.009 | 0.007** |
| 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 U.S. | -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 | |
| $\rho$ (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 to account for multiple births to the same mother.

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

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

**Table 4.5. Recursive 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* | | | | | | |
| Child care available | 0.395 | 0.141 | 0.114** | -0.087 | 0.158 | -0.015 |
| Flexible schedule available | -0.120 | 0.085 | -0.030 | 0.036 | 0.096 | 0.006 |
| Hours work at home | 0.019 | 0.007 | 0.005** | 0.007 | 0.007 | 0.001 |
| 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 U.S. | -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 | |
| $\rho$ (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 to account for multiple births to the same mother.

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

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

**Table 4.6. Do Fertility Desires Predict Possession of a Job with Specific Workplace Characteristics?**

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

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 U.S., urban, reside in the Northeast, reside in the South, reside in the West, AFQT score, first birth, multiple birth, and year fixed effects.

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

b. Coefficients from OLS models.

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

**Table 4.7. Do Women Select Jobs with Workplace Characteristics Facilitating Breastfeeding Before Birth?**

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

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 U.S., urban, reside in the Northeast, reside in the South, reside in the West, AFQT score, multiple birth, and year fixed effects.
a. Marginal effects from probit models are evaluated at the means of the independent variables.
b. Coefficients from OLS models.
* significant at 5 percent level; ** significant at 1 percent level

**Table 4.8. Effect Sizes from U.S. Randomized Control Trials 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) | Postpartum 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 includes group visits, one-on-one clinic visits, and breastfeeding consultation.
e. In this study, usual care is a pediatric clinic visit.

# CHAPTER 5. CONCLUSION

While breastfeeding patterns are well-documented, the explanations for them are not. Because of the potential benefits of breastfeeding to approximately four million infants and mothers in the U.S. each year, this dissertation investigates three explanations of breastfeeding patterns identified in the literature that have not been previously tested empirically. This dissertation contributes to this important policy problem by investigating whether the following factors influenced breastfeeding over the last decade 1) demographic changes; 2) welfare work requirements; and 3) workplace characteristics.

The dissertation first examines whether increases in breastfeeding rates since 1991 can be attributed to demographic changes. To answer the research question this study decomposes breastfeeding trends using 1991 through 2002 data from the Ross Laboratories Mothers Survey (RLMS) and birth certificate data. This analysis suggests that changes in the composition of births by the following comprehensive set of demographic characteristics explain approximately 20 percent of the upward trend in initiation and duration breastfeeding rates during the 1990s: maternal age, maternal education, race/ethnicity, birth order, and geographic location of birth. The changes in birth composition by maternal age and education are the most important of these factors, explaining 9.8 and 11.5 percent of the increase in breastfeeding initiation rates, respectively. Similar results are observed for breastfeeding rates six months after birth, with birth composition changes by maternal age and education explaining 10.2 and 9.0 percent of increasing breastfeeding rates, respectively. While the results do explain approximately 20 percent of the upward trend in breastfeeding rates, they also underscore the importance of exploring the effects of other factors on breastfeeding rates.

The third chapter examines whether the work requirements adopted as part of welfare reform have affected the prevalence of breastfeeding. A central theme of the recent welfare reform is the requirement that welfare recipients engage in work-related activities. In many states this requirement applies to mothers whose children are just a few months old. Holding a job increases the costs of breastfeeding, which in turn could reduce the propensity of new mothers to breastfeed their children. Both the descriptive statistics described earlier and multivariate studies illustrate that working negatively affects breastfeeding. Therefore, it is important to understand how these welfare work requirements affect breastfeeding rates. The analyses of data from the RLMS, presented in Chapter 3, suggest that if welfare reform had not been adopted, national breastfeeding rates six months after birth would be 5.5 percent higher.

Chapter 4 of the dissertation seeks to understand the role of workplace characteristics in the breastfeeding practices of working women. Working women are an important group to study because they comprise a large portion of new mothers, with over half (50.4 percent) of mothers with infants under 12 months of age working in 2002 (BLS 2003). As mentioned earlier, working women are also less likely to breastfeed than their non-working counterparts. The effects of availability of employer-sponsored child care, availability of a flexible schedule, hours worked at home, and working a rotating schedule on breastfeeding outcomes are estimated using the National Longitudinal Survey of Youth 1979 (NLSY79). The availability of employer-sponsored child care increases the likelihood of breastfeeding six months after birth by 59 percent. In addition, working an additional eight hours at home per week increases the probability of breastfeeding by approximately 9 and 21 percent at birth and six months after birth, respectively.

Three important lessons emerge from this dissertation. The first lesson is generated by

exploring the rise in breastfeeding rates that began in 1991. Findings from this dissertation suggest that approximately 20 percent of the upward trend in breastfeeding rates is explained by well-known demographic changes. In contrast, findings suggest that welfare work requirements negatively influence breastfeeding rates, indicating that welfare reform does not help explain breastfeeding increases. In fact, breastfeeding rates would have been higher in the absence of welfare reform.

This dissertation also finds that some workplace characteristics positively influence breastfeeding rates. Because of data limitations, it is not possible to empirically test whether workplace characteristics explain the increase in breastfeeding rates. However, ample information is available to hypothesize that if workplace characteristics explain any of the increase in breastfeeding rates since 1991, it is a small portion. It is generally believed that the prevalence of family-friendly workplace characteristics increased over the last decade, which suggests that workplace characteristics might explain some of the upward trend in breastfeeding rates. However, a little over 50 percent of mothers with children age one and under work and an even smaller portion of these working mothers have workplace characteristics that facilitate breastfeeding available. These two factors suggest that workplace characteristics play a small role in the recent increases in breastfeeding rates. Finally, the passage of two types of state breastfeeding laws is explored in this dissertation. Analyses suggest that these laws had little impact on national breastfeeding rates, indicating that they do not explain increases in breastfeeding rates.

While a portion of the increase in breastfeeding rates are explained by demographic changes, this dissertation demonstrates that other factors play a larger role in influencing breastfeeding trends and we need to continue exploring other explanations for the increases.

Factors that might explain increases in breastfeeding rates are technological innovation and increased information. Technological innovation includes more advanced and less expensive breast pumps. On the other hand, innovations in formula technology may also contribute to lower breastfeeding rates. Increased public information on breastfeeding might also explain rising breastfeeding rates. The increasing number of research studies illustrating the benefits of breastfeeding and public health informational campaigns promoting breastfeeding is well-documented. However, it is not known whether this rise in information on the benefits of breastfeeding has lead to the observed increases in breastfeeding since 1991.

The second lesson learned from this dissertation is that policies can have unintended consequences that counter the efforts of other policies and programs. Results from this dissertation suggest that welfare work policies imposed a significant unintended cost on infants and their mothers by reducing the prevalence of breastfeeding and contributing to health disparities between the poor and non-poor. Thus, while the primary intention of welfare work requirements is to increase self-sufficiency among impoverished mothers, the policy has negative unintended consequences on breastfeeding and health disparities, both public health problems that the federal government is actively trying to address. The government must weigh the cost of these welfare work requirements against the potential benefits associated with them. However, the vast majority of the harmful effects on breastfeeding would be eliminated if mothers of infants were not required to work full-time, a requirement that is currently in place in about half of all states. Policies to facilitate breastfeeding among working mothers should also be explored.

The final lesson learned is the importance of understanding the underlying reasons for behavioral patterns when developing policy. For example, it is well-documented that women who work are less likely to breastfeed than those who do not, but it is not understood why some

working women breastfeed and others do not. To create effective policies to increase breastfeeding among working women, it is crucial to understand the underlying reasons for their differences in behavior. This dissertation demonstrates that both working from home and the availability of employer-sponsored child care are promising practices to increase breastfeeding rates among working women. However, for the most part, these are not the practices promoted by the state breastfeeding laws.

To further understand the role of workplace characteristics in breastfeeding, more information on workplace characteristics is necessary. Of the workplace characteristics offered those most likely to affect breastfeeding include availability of a lactation room, an office with a door, employer policies regarding job-sharing, and the frequency and duration of breaks. Future data collection efforts on the topic should include questions on these workplace characteristics.

# APPENDICES

## APPENDIX: MISSING DATA

Observations with missing values for variables not part of the exclusion criteria are addressed in the following manner. Variables with less than 10 percent of its values missing 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). Three variables have 10 percent or more of its values missing; therefore, I include a binary variable for each to indicate if a value is missing. Eleven percent of the low birth-weight values are missing, 11.5 percent of the values of the smoking variable are missing, and 12 percent of the cesarean section values are missing. None of these dummy variables are statistically significant.

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.

**Table A.1. 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* | |
| Child care available | Employer-sponsored child care available prior to birth |
| Flexible schedule available | Flexible work schedule or hours available prior to birth |
| Hours work at home | Hours per week usually worked at home 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 U.S. | 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 A.1. 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 prior to birth started job | Years prior to birth that a mother began her current job |
| 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 A.2. 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% | 1989-1991: 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% | 1989: 3.00% |
| Hawaii | 1999 | 1999 | 4.00% | |
| Idaho | - | - | 5.00% | |
| Illinois | 1995 | - | 6.25% | 1989: 5.00% |
| Indiana | - | - | 0.00% | |
| Iowa | 1999 | - | 0.00% | |
| Kansas | - | - | 4.90% | 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% | 1989-1992: 6.00% |
| Missouri | 1999 | - | 4.23% | |
| Montana | 1999 | - | 0.00% | |
| Nebraska | - | - | 5.00% | 1989-1991: 4.00% |
| Nevada | 1995 | - | 0.00% | |
| New Hampshire | 1999 | - | 0.00% | |
| New Jersey | 1997 | - | 0.00% | |
| New Mexico | 1999 | - | 5.00% | 1989-1990: 4.75% |
| New York | 1984 | - | 0.00% | |
| North Carolina | 1993 | - | 4.00% | 1989-1991: 3.00% |
| North Dakota | - | - | 0.00% | |
| Ohio | - | - | 0.00% | |

**Table A.2. 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% | 1989-1990: 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% | 1989-1992: 5.50% |
| Texas | 1995 | 1995 | 0.00% | |
| Utah | 1995 | - | 4.75% | 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% | 1989-1993: 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 A.3. Marginal Effects from Probit Models on Breastfeeding Outcomes Excluding Work Status**

| | Breastfeeding initiation | | Breastfeeding at 6 months | |
|---|---|---|---|---|
| | ***Marginal effect[a]*** | ***Standard error[b]*** | ***Marginal effect[a]*** | ***Standard error[b]*** |
| *Workplace characteristics and work status* | | | | |
| Child care available | 0.035 | (0.050) | 0.117* | (0.046) |
| Flexible schedule available | 0.020 | (0.030) | -0.035 | (0.022) |
| Hours work at home | 0.006* | (0.003) | 0.005** | (0.002) |
| Work rotating schedule | 0.023 | (0.053) | 0.002 | (0.037) |
| *Maternal characteristics* | | | | |
| Age | -0.004 | (0.007) | -0.001 | (0.006) |
| Non-Hispanic Black | -0.079 | (0.048) | -0.068* | (0.031) |
| Hispanic | 0.072 | (0.045) | -0.012 | (0.033) |
| Born in the U.S. | -0.082 | (0.06) | -0.007 | (0.044) |
| No college | -0.097* | (0.047) | -0.047 | (0.030) |
| Some college | -0.075 | (0.046) | -0.019 | (0.029) |
| AFQT score | 0.005** | (0.001) | 0.002** | (0.001) |
| Smoke | -0.119** | (0.04) | -0.078** | (0.024) |
| Receive any public assistance | 0.135 | (0.154) | -0.006 | (0.120) |
| Family size | -0.004 | (0.014) | 0.000 | (0.012) |
| Husband/partner present | 0.073 | (0.045) | -0.012 | (0.035) |
| *Birth characteristics* | | | | |
| Low birth-weight | -0.149** | (0.057) | -0.077* | (0.031) |
| C-section performed | -0.064 | (0.036) | -0.024 | (0.024) |
| First birth | 0.039 | (0.034) | 0.023 | (0.026) |
| Multiple birth | -0.058 | (0.126) | -0.092 | (0.051) |
| *Contextual variables* | | | | |
| Reside in the Northeast | -0.017 | (0.05) | 0.023 | (0.039) |
| Reside in the South | -0.058 | (0.043) | -0.009 | (0.031) |
| Reside in the West | 0.173** | (0.045) | 0.111** | (0.043) |
| Public breastfeeding law | -0.055 | (0.050) | 0.047 | (0.038) |
| Employment breastfeeding law | 0.234** | (0.052) | -0.042 | (0.047) |
| State food tax rate | 1.432 | (0.743) | 1.475** | (0.556) |
| Mean of the dependent variable | 0.596 | | 0.195 | |
| Pseudo R-squared | 0.167 | | 0.118 | |

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 to account for multiple births to the same mother.

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

**Table A.4. Marginal Effects from Probit Models on Breastfeeding Outcomes Including Work Status**

| | Breastfeeding initiation | | Breastfeeding at 6 months | |
|---|---|---|---|---|
| | ***Marginal effect***[a] | ***Standard error***[b] | ***Marginal effect***[a] | ***Standard error***[b] |
| *Workplace characteristics and work status* | | | | |
| Child care available | 0.032 | (0.050) | 0.115* | (0.046) |
| Flexible schedule available | 0.019 | (0.030) | -0.033 | (0.022) |
| Hours work at home | 0.006* | (0.003) | 0.005** | (0.002) |
| 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 U.S. | -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 to account for multiple births to the same mother.

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

**REFERENCES**

American Academy of Pediatrics. 1997. "Breastfeeding and the Use of Human Milk." *Pediatrics* 100(6):1035-39.

Auerbach, Kathleen G. 1984. "Employed Breastfeeding Mothers: Problems They Encounter." *Birth* 11(1):17-20.

Avertt, Susan L., and Leslie A. Whittington. 2001. "Does Maternity Leave Induce Births?" *Southern Economic Journal* 68(2):403-417.

Barber-Madden, Rosemary, Marybeth Albanese Petschek, and Jean Pakter. 1987. "Breastfeeding and the Working Mother: Barriers and Intervention Strategies." *Journal of Public Health Policy* 8:531-541.

Bartlett, S., R. Olvera, N. Gill, and M. Laramie. 2002. "WIC Participant and Program Characteristics 2000." Special Nutrition Programs Report No. WIC-02-PC. Office of Analysis, Nutrition, and Evaluation, Food and Nutrition Service, U.S. Department of Agriculture.

Baydar, Nazli, Margaret McCann, Rick Williams, and Eric Vesper. 1997. "Final Report: WIC Infant Feeding Practices Study." Virginia: United States Department of Agriculture, Food and Nutrition Service.

Beaudry, M., R. Dufour, and S. Marcoux. 1995. "Relation Between Infant Feeding and Infections During the First Six Months of Life." *The Journal of Pediatrics* 126(2):191-97.

Bitler, M.P., J.B. Gelbach, and H.W. Hoynes. 2003. "The Impact of Welfare Reform on Living Arrangements." January manuscript.

Brent, Nancy B., Beverly Redd, April Dworetz, Frank D'Amico, and Joseph Greenberg. 1995. "Breast-feeding in a Low-Income Population: Program to Increase Incidence and Duration." *Archives of Pediatric & Adolescent Medicine* 149:798-803.

Bureau of Labor Statistics (BLS). 2003. "Employment Characteristics of Families in 2002." Washington, D.C.: United States Department of Labor, Bureau of Labor Statistics.

Bureau of Labor Statistics (BLS). 2002. "Employment Characteristics of Families in 2001." Washington, D.C.: United States Department of Labor, Bureau of Labor Statistics.

Burstein, Nancy, Mary Kay Fox, Jordan Hiller, Robert Kornfeld, Ken Lam, Cristofer Price, and David Rodda. 2000. "WIC General Analysis Project: Profile of WIC Children." Virginia: United States Department of Agriculture, Food and Nutrition Service.

Cancian, Maria, Sheldon Danzinger, and Peter Gottschalk. 1992. "Working Wives and Family Income Inequalities Among Married Couples." In Sheldon Danzinger and Peter Gottschalk, eds. *Uneven Tides: Rising Inequality in America*. New York: Russell Sage Foundation.

Center for Human Resource Research. 2001. "NLSY79 User's Guide." Ohio: The Ohio State University.

Chatterji, Pinka, Karen Bonuck, Simi Dhawan, and Nandini Deb. 2002. "WIC Participation and the Initiation and Duration of Breastfeeding." Wisconsin: Institute for Research on Poverty Discussion Paper No. 1246-02.

Chatterji, Pinka, and Kevin Frick. 2003. "Does Returning to Work After Childbirth Affect Breastfeeding Practices?" Massachusetts: NBER Working Paper 9630.

Cohen, Rena, Marsha B. Mrtek, and Robert G. Mrtek. 1995. "Comparison of Maternal Absenteeism and Infant Illness Rates Among Breastf-feeding and Formula-feeding Women in Two Corporations." *American Journal of Health Promotion* 10(2): 148-153.

Corbett-Dick, Patricia, and Susan K. Bezek. 1997. "Breastfeeding Promotion for the Employed Mother." *Journal of Pediatric Health Care* 11:12-19.

Council of Economic Advisors (CEA). 1999. "The Effects of Welfare Policy and the Economic Expansion on Welfare Caseloads: An Update." A Report by the Council of Economic Advisors.

Council of Economic Advisors (CEA). 1997. "Explaining the Decline in Welfare Receipt, 1993-1996." A Report by the Council of Economic Advisors.

DaVanzo, Julie, Ellen Starbird, and Arleen Leibowitz. 1990. "Do Women's Breastfeeding Experiences with Their First-borns Affect Whether They Breastfeed Their Subsequent Children?" *Social Biology* 37(3-4):223-232.

Duncan, B., J. Ey, C.J. Holberg, A.L. Wright, F.D. Martinez, and L.M. Taussig. 1993. "Exclusive Breast-Feeding for at Least 4 Months Protects Against Otitis Media." *Pediatrics* 91(5):867-72.

Ellwood, D.T. 2000. "The Impact of the Earned Income Tax Credit and Social Policy Reforms on Work, Marriage, and Living Arrangements." *National Tax Journal* 53(4):1063-105.

Escobar, Gabriel J., Paula A. Braveman, Lynn Ackerson, Roxana Odouli, Kim Coleman-Phox, Angela M. Capra, Carlene Wong, and Tracy A. Lieu. 2001. "A Randomized Comparison of Home Visits and Hospital-Based Group Follow-up Visits After Early Postpartum Discharge." *Pediatrics* 108(3):719-727.

Evans, William N., and Robert M. Schwab. 1995. "Finishing High School and Starting College: Do Catholic Schools Make a Difference?" *The Quarterly Journal of Economics* 110(4):941-974.

Fein, Sara B., and Brian Roe. 1998. "The Effect of Work Status on Initiation and Duration of Breast-Feeding." *American Journal of Public Health* 88(7):1042-1046.

Forste, Renata, Jessica Weiss, and Emily Lippincott. 2001. "The Decision to Breastfeed in the United States: Does Race Matter?" *Pediatrics* 108(1):291-296.

Freed, Gary L., Sarah J. Clark, Jacob A. Lohr, and James R. Sorenson. 1995a. "Pediatrician Involvement in Breast-Feeding Promotion: A National Study of Residents and Practitioners." *Pediatrics* 96:490-494.

Freed, Gary L., Sarah J. Clark, James R. Sorenson, Jacob A. Lohr, Robert Cefalo, and Peter Curtis. 1995b. "National Assessment of Physicians' Breast-feeding Knowledge, Attitudes, Training, and Experience." *JAMA* 273(6):472-476.

Greene, William H. 2000. *Econometric Analysis*. New Jersey: Prentice Hall, Incorporated.

Grogger, J. Forthcoming. "The Effects of Time Limits, the EITC, and Other Policy Changes on Welfare Use, Work, and Income Among Female-Headed Families." *The Review of Economics and Statistics*.

Grogger, J., S. J. Haider, and J.A. Klerman. 2003. "Why Did the Welfare Caseload Fall During the 1990s? The Importance of Entry." *American Economic Review Papers and Proceedings* 93(2):288-92.

Grogger, J., L.A. Karoly, and J.A. Klerman. 2002. "Consequences of Welfare Reform: A Research Synthesis." DRU-2676-DHHS. RAND.

Grossman, Lindsey K., Christina Harter, Larry Sachs, and Amparo Kay. 1990. "The Effect of Postpartum Lactation Counseling on the Duration of Breast-feeding in Low-Income Women." *American Journal of Diseases of Children* 144:471-474.

Grummer-Strawn, Laurence M,. and Ruowei Li. 2001. "U.S. National Surveillance of Breastfeeding Behavior." *Journal of Human Lactation* 16(4):283-290.

Hamilton, G., S. Freedman, L. Gennetian, C. Michalopoulos, J. Walter, D. Adams-Ciardullo, A. Gassman-Pines, S. McGroder, M. Zaslow, J. Brooks, and S. Ahluwalia. 2001. "National Evaluation of Welfare-to-Work Strategies: How Effective Are Different Welfare-to-Work Approaches? Five-Year Adult and Child Impacts for Eleven Programs." U.S. Department of Health and Human Services and U.S. Department of Education.

Hediger, Mary, Mary Overpeck, Robert Kuczmarski, and W. June Ruan. 2001. "Association Between Infant Breastfeeding and Overweight in Young Children." *The Journal of the American Medical Association* 285(19):2453-2460.

Hills-Bonczyk, S.G., M.D. Avery, K. Savik, S. Potter, and L.J. Duckett. 1993. "Women's Experiences With Combining Breast-Feeding and Employment." *Journal of Nurse Midwifery* 38(5):257-66.

Hoey, Christine and Julie Ware. 1997. "Economic Advantages of Breastfeeding in an HMO Setting: A Pilot Study." *American Journal of Managed Care* 3(6):861-865.

Horwood, L.J. and D.M. Fergusson. 1998. "Breastfeeding and Later Cognitive and Academic Outcomes." *Pediatrics* 101(1):e9.

Jacknowitz, Alison. 2002. "Estimating Eligibility for WIC: The Role of Breastfeeding." California: RAND Graduate School, Working Paper.

Keck, Canada. 1997. “The Initiation and Duration of Breastfeeding Among Employed Women in the United States.” Ohio: The Ohio State University, dissertation.

Kistin, Naomi, Dessa Benton, Sita Rao, and Myrtis Sullivan. 1990. “Breast-feeding Rates Among Black Urban Low-Income Women: Effect of Prenatal Education.” *Pediatrics* 86(5):741-746.

Kramer, Michael, and Ritz Kakuma. 2002. “Optimal Duration of Exclusive Breastfeeding (Cochrane Review).” *The Cochrane Library* 2003(2).

Labbok, Miriam H. 2001. “Effects of Breastfeeding on the Mother.” *Pediatric Clinics of North America* 48(1):143-158.

La Leche League International. 2001. "A Current Summary of Breastfeeding Legislation in the U.S.." Illinois: La Leche League International. Available on-line: http://www.lalecheleague.org.

Lawrence, R.A. 2000. “Breastfeeding: Benefits, Risks, and Alternatives.” *Current Opinion in Obstetrics and Gynecology* 12(6):519-24.

Leon-Cava, Natalia, Chessa Lutter, Jay Ross, and Luann Martin. 2002. “Quantifying the Benefits of Breastfeeding: A Summary of the Evidence.” Washington, D.C.: Pan American Health Organization.

Lieu, Tracy A., Paula A Braveman, Gabriel J. Escobar, Allen F. Fischer, Nancy G. Jensvold, and Angela M. Capra. 2000. “A Randomized Comparison of Home and Clinic Follow-up Visits After Early Postpartum Hospital Discharge.” *Pediatrics* 105:1058-1065.

Lindberg, Laura Duberstein. 1996a. “Women’s Decisions About Breastfeeding and Maternal Employment.” *Journal of Marriage and Family* 58:239-251.

Lindberg, Laura Duberstein. 1996b. "Trends in the Relationship Between Breastfeeding and Postpartum Employment in the United States." *Social Biology* 43(3-4):191-202.

Locklin, M.P. and S.J. Naber. 1993. "Does Breastfeeding Empower Women? Insights From a Select Group of Educated, Low-Income, Minority Women." *Birth* 20(1):30-35.

Lucas, A., R. Morley, T.J. Cole, G. Lister, and C. Leeson-Payne. 1992. "Breast Milk and Subsequent Intelligence Quotient in Children Born Preterm." *Lancet* 339(8788):261-64.

Mathews, TJ, and Brady E. Hamilton. 2002. "Mean Age of Mother, 1970-2000." *National Vital Statistics Reports* 51(1), December 11th.

McIntyre, Lee. 2000. "Childcare on Board: The Growth of Work-Site DayCare." *Regional Review* 10(3):8-15.

McTiernan, A. and D.B. Thomas. 1986. "Evidence for a Protective Effect of Lactation on Risk of Breast Cancer in Young Women. Results from a Case-Control Study." *American Journal of Epidemiology* 124(3):353-58.

Meek, Joan Y. 2001. "Breastfeeding in the Workplace." *Pediatric Clinics of North America* 48(2):461-474.

Mellor, Jennifer M. 1998. "The Effect of Family Planning Programs on the Fertility of Welfare Recipients: Evidence from Medicaid Claims." *Journal of Human Resources* 33(4):866-895.

Meyer, B.D. and D.T. Rosenbaum. 2001. "Welfare, the Earned Income Tax Credit, and the Labor Supply of Single Mothers." *Quarterly Journal of Economics* 116(3):1063-114.

Meyer, B.D. and J.X. Sullivan. 2001. "The Effects of Welfare and Tax Reform: The Material Well-Being of Single Mothers in the 1980s and 1990s." Working Paper No. W8298. National Bureau of Economic Research.

Moffitt, R.A. 1999. “The Effect of Pre-PRWORA Waivers on AFDC Caseloads and Female Earnings, Income, and Labor Force Behavior.” Pp. 91-118 in *Economic Conditions and Welfare Reform*, edited by S.H. Danziger. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

Montgomery, D.L. and P.L. Splett. 1997. "Economic Benefit of Breast-Feeding Infants Enrolled in WIC." *Journal of the American Dietetic Association* 97(4):379-85.

Moore, Jayne F., and Nancy Jansa. 1987. “A Survey of Policies and Practices in Support of Breastfeeding Mothers in the Workplace.” *Birth* 14(4):191-195.

National Center for Health Statistics (NCHS). 2003. “Births: Final Data for 2002.” *National Vital Statistics Reports* 52(10):1-116.

National Center for Health Statistics (NCHS). 2001. “Health, United States, 2001.” Maryland: Department of Health and Human Services Publication No. (PHS) 01-1232.

National Center for Health Statistics (NCHS). 1998. “Health, United States, 1998 with Socioeconomic Status and Health Chart Book.” Maryland.

National Center for Health Statistics (NCHS). 1993. “Advance Report of Final Natality Statistics.” *Monthly Vital Statistics Report* 42(3S):1-48.

O’Neill, J.E. and M.A. Hill. 2001. “Gaining Ground? Measuring the Impact of Welfare Reform on Welfare and Work.” Civic Report #17. Manhattan Institute for Policy Research.

Paxson, C. and J. Waldfogel. 2003. “Welfare Reforms, Family Resources, and Child Maltreatment.” *Journal of Policy Analysis and Management* 22(1):85-113.

Pugh, Linda C., and Renee A. Milligan. 1998. “Nursing Intervention to Increase the Duration of Breastfeeding.” *Applied Nursing Research* 11(4):190-194.

Pugh, Linda C., Renee A. Milligan, Kevin D. Frick, Diane Spatz, and Yvonne Bronner. 2002. "Breastfeeding Duration, Costs, and Benefits of a Support Program for Low-Income Breastfeeding Women." *Birth* 29(2):95-100.

Rector, R.E. and S.E. Youssef. 1999. "The Determinants of Welfare Caseload Decline." Paper #CDA99-04. The Heritage Foundation.

Riordan, Jan, and Kathleen G. Auerbach. 1998. *Breastfeeding and Human Lactation*. Massachusetts: Jones and Bartlett Publishers.

Roe, Brian, Leslie A. Whittington, Sara Beck Fein, and Mario F. Teisl. 1999. "Is There Competition Between Breast-Feeding and Maternal Employment?" *Demography* 36(2):157-171.

Rowe, G. 2000. "State TANF Policies as of July 1999." Report. Urban Institute.

Ryan, Alan. 2002. "Breastfeeding Trends Through 2002." Ohio: Ross Products Division Working Paper.

Ryan, Alan. 2001 "Breastfeeding Trends Through 2001." Ohio: Ross Products Division Working Paper.

Ryan, Alan. 1997. "The Resurgence of Breastfeeding in the United States." *Pediatrics* 99(4):e12.

Ryan, Alan, William Pratt, Jeffrey Wysong, Gregory Lewandowski, James McNally, and Fritz W. Krieger. 1991. "A Comparison of Breast-Feeding Data from the National Surveys of Family Growth and the Ross Laboratories Mothers Survey." *American Journal of Public Health* 81(8):1049-1052.

Ryan, Alan S., Zhou Wenjun, and Andrew Acosta. 2002. "Breastfeeding Continues to Increase Into the New Millennium." *Pediatrics* 110(6):1103-1108.

Schanler, Richard J, Karen G. O'Connor, and Ruth A. Lawrence. 1999. “Pediatricians’ Practices and Attitudes Regarding Breastfeeding Promotion.” *Pediatrics* 103(3):e35.

Schoeni, R.F. and R. Blank. 1999. “What Has Welfare Reform Accomplished? Impacts on Welfare Participation, Employment, Income, Poverty and Family Structure.” Working Paper No. W7627. National Bureau of Economic Research.

Serafino-Cross, Paula, and Patricia R. Donovan. 1992. “Effectiveness of Professional Breastfeeding Home-Support.” *Journal of Nutrition Education* 24:117-122.

Serwint, Janet R., Modena E.H. Wilson, Judith W. Vogelhut, John T. Repke, and Henry M. Seidel. 1996. “A Randomized Controlled Trial of Prenatal Pediatric Visits for Urban, Low-income Families.” *Pediatrics* 98(6):1069-1075.

Simmons GSM Marketing Team. 1997. “Benefits of Work-Site Child Care.” Massachusetts: Simmons College Marking Project.

Tuttle, C.R. and K.G. Dewey. 1996. "Potential Cost Savings for Medi-Cal, AFDC, Food Stamps, and WIC Programs Associated With Increasing Breast-Feeding Among Low-Income Hmong Women in California." *Journal of the American Dietetic Association* 96(9):885-90.

United States Department of Health and Human Services (U.S. DHHS). 2000. “HHS Blueprint for Action on Breastfeeding.” Washington, D.C.: United States Department of Health and Human Services, Office of Women’s Health.

Visness, Cynthia M., and Kathy I. Kennedy. 1997. “Maternal Employment and Breast-Feeding: Findings from the 1988 National Maternal and Infant Health Survey.” *American Journal of Public Health* 87(6):945-950.

Waldfogel, Jane. 1997. "Working Mothers Then and Now: A Cross-Cohort Analysis of the Effects of Maternity Leave on Women's Pay." Pp. 92-126 in *Gender & Family Issues in the Workplace*, edited by Francine D. Blau and Ronald G. Ehrenberg. New York: Russell Sage Foundation.

Weimer, Jon. 2001. "The Economic Benefits of Breastfeeding: A Review and Analysis." Washington, D.C.: USDA, Economic Research Service, FANRP #13.

Wright, Anne L. 2001. "The Rise of Breastfeeding in the United States." *Pediatric Clinics of North America* 48(1):1-10.

Ziliak, J.P., D.N. Figlio, E.E. Davis, and L.S. Connolly. 2000. "Accounting for the Decline in AFDC Caseloads: Welfare Reform or the Economy?" *The Journal of Human Resources* 35(3):570-86.