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Paid maternity leave and breastfeeding practice before and after California's implementation of the nation's first paid family leave program

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ABSTRACT

California was the first state in the United States to implement a paid family leave (PFL) program in 2004. We use data from the Infant Feeding Practices Study to examine the changes in breastfeeding practices in California relative to other states before and after the implementation of PFL. We find an increase of 3–5 percentage points for exclusive breastfeeding and an increase of 10–20 percentage points for breastfeeding at several important markers of early infancy. Our study supports the recommendation of the Surgeon General to establish paid leave policies as a strategy for promoting breastfeeding.

1. Introduction

Breastfeeding has tremendous benefits for infants. It reduces the risks of many adverse health outcomes, such as sudden infant death syndrome (SIDS), asthma, diabetes, and obesity (Ip et al., 2007). Breastfeeding also benefits the mother by reducing the risks of breast and ovarian cancers (U.S. Department of Health and Human Services, 2011). The benefits of breastfeeding can be long lasting. For instance, based on breastfeeding practice data from Imperial Germany (1871–1919), Haines and Kintner's (2008) study indicates that breastfeeding could improve later life outcomes such as final adult stature, possibly by improving infant and early childhood health. Using data from India in 1998–1999, Brennan et al. (2004) find that some recommended infant feeding practices, such as exclusive breastfeeding for the first four to six months, could reduce stunted growth among India's children. "Exclusive breastfeeding" refers to feeding an infant only with its mother's breast milk and without any other food or liquid. The economic benefits of breastfeeding are also significant for families, employers, and the society (U.S. Department of Health and Human Services, 2011). It is estimated that if 90 percent of the U.S. families follow medical recommendations to breastfeed exclusively for the first six months, the United States could save $13 billion annually from reduced medical and other costs (Bartick and Reinhold, 2010).

According to the report card prepared by the Centers for Disease Control and Prevention (CDC), the national average breastfeeding rates for children born in 2009 were 76.9 percent in the early postpartum period, 47.2 percent in the first six months, and 25.5 percent in the first year; concerning exclusive breastfeeding, the rates are 36.0 percent in the first three months and 16.3 percent in the first six months (Breastfeeding Report Card, 2012). Although the breastfeeding rates noted above have met

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or approximated the goals of *Healthy People 2010*,[1] they all fall short of the newly revised goals of *Healthy People 2020*, which targets increasing the proportion of mothers who breastfeed: (1) in early postpartum period, up to 81.9 percent; (2) in the first six months, up to 60.6 percent; (3) in the first year, up to 34.1 percent; (4) exclusively through the first three months, up to 46.2 percent; and (5) exclusively through the first six months, up to 25.5 percent (Breastfeeding Report Card, 2012).

Despite the fact that breastfeeding has many benefits, early cessation is common in the United States. One reason consistently identified is mothers' returning to work (Baker and Milligan, 2008). To date, there have been calls for providing more generous maternity leaves (Calnen, 2010; Guendelman et al., 2009; Kurinij et al., 1989; Roe et al., 1999; U.S. Department of Health and Human Services, 2011), which can have a significant impact on mothers' decision to return to work after childbirth (Dustmann and Schönberg, 2012) and breastfeeding practice (Berger et al., 2005; Fein and Roe, 1998; Kimbro, 2006; Visness and Kennedy, 1997). A report by Fass (2009) points out that the United States lacks adequate public policies supporting workers' work-and-family balance, and in fact the United States is one of the four countries—together with Liberia, Papua New Guinea, and Swaziland—that do not guarantee paid leave to new mothers.

In contrast, by 1994 all Western European countries offered at least 10 weeks of job-protected, paid parental leave (Ruhm, 2000), which was used predominantly by women as maternity leave (Ruhm, 1998). Using data from Greece and eight countries[2] in Western Europe between 1969 and 1993, Ruhm (1998) finds that granting short periods (three months) of paid parental leave increases the female employment-to-population ratio by 3–4 percent but has little effect on women's earnings.[3]

A more recent study by Lalive and Zweimüller (2009) investigates two parental leave reforms from Austria: an expansion of job-protected, paid parental leave from one to two years in 1990, and a subsequent reduction from two years to 18 months in 1996. Their study finds that most women use up the maternity leaves they are eligible for, with increased probability (10 percentage points in the short term and 3 percentage points in the long term) of postponing the return to work after they exhaust the maternity leaves. Their study also finds that the 1990 reform decreases women's work experience and earnings in the short run, whereas the 1996 reform partially undoes the short-term effects of the 1990 reform. But, their study does not find the impacts of longer leaves on work experience and cumulative earnings in the long run.

Focusing on Canada, two studies have investigated the impacts of the expansion of Canadian job-protected, paid family leave from 25 to 50 weeks. The expansion began on December 31, 2000. Hanratty and Trzcinski's (2009) study finds that the expansion is associated with a decrease of 20 percentage points (or 40%) in the proportion of women returning to work within one year after childbirth, but the women's returns to work converge to previous levels once their paid leaves are exhausted. Baker and Milligan (2008) estimate that the Canadian family-leave expansion increases the duration of leave taken by those eligible women by 3–3.5 months during the first year after childbirth. They also find significant increases in the duration of breastfeeding (1–1.17 months) and exclusive breastfeeding (0.51–0.59 months). Furthermore, they find that the rate of exclusive breastfeeding through the first six months increases by 7.7–9.1 percentage points (or 38.7–45.5%).

Our study explores a landmark change in the law that provides *partially* paid family leave (PFL) to working Californians. "Family leave" refers to an absence from work granted to an employee, male or female, to care for a family member, such as a new child or a sick spouse or parent. It can be used for maternity or paternity leave. In September 2002, California became the first state in the United States to pass a PFL law, which took effect on July 1, 2004 and has been used primarily as maternity leave for bonding with newborns.

Prior to PFL, the federal Family and Medical Leave Act (FMLA, effective in 1993) represents an important workplace benefit but leaves much to be desired. FMLA allows eligible employees to take up to 12 weeks of job-protected leave annually for bonding with a new child or taking care of seriously ill immediate family members (including oneself), but it does not require employers to pay for the leave. Hence, a loss of income has been cited consistently as the top reason for not taking family leave. Moreover, eligibility criteria under FMLA are strict. FMLA covers private and state-and-local government employees, plus some federal workers, provided that they: (1) work for a covered employer[4]; (2)

[1] *Healthy People 2010* targets increasing the proportion of mothers who breastfeed: (1) in early postpartum period, up to 75 percent; (2) in the first six months, up to 50 percent; (3) in the first year, up to 25 percent; (4) exclusively through the first three months, up to 40 percent; and (5) exclusively through the first six months, up to 17 percent (Breastfeeding Report Card, 2010).

[2] These eight countries are Denmark, Finland, France, Germany, Ireland, Italy, Norway, and Sweden.

[3] In a follow-up study based on data from Greece and 15 countries in Western Europe (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom) from 1969 to 1994, Ruhm (2000) finds that more generous paid leave could reduce deaths of infants and young children. In addition, Osmani and Sen (2003) find that women's lack of health care could lead to ill health of their offspring—males and females, as children and as adults. A study by Komlos and Baur (2004) finds that during the course of the 20th century, the U.S. population became shorter and fatter than the Western Europeans, which was exactly the opposite of what happened in the mid-19th century. As Komlos and Baur (2004) point out, this dramatic reversal could be explained by the less social inequality, better access to health care, and more social safety nets in Western Europe than in the United States. In our view, one of these differences is reflected by the different maternity leave benefits received by U.S. and Western European women.

[4] "An employer covered by FMLA is any person engaged in commerce or in any industry or activity affecting commerce, who employs 50 or more employees for each working day during each of 20 or more calendar workweeks in the current or preceding calendar year. Employers covered by FMLA also include any person acting, directly or indirectly, in the interest of a covered employer to any of the employees of the employer, any successor in interest of a covered employer, and any public agency. Public agencies are covered employers without regard to the number of employees employed. Public as well as private elementary and secondary schools are also covered employers without regard to the number of employees employed." (Source: http://www.gpo.gov/fdsys/pkg/CFR-2002-title29-vol3/pdf/CFR-2002-title29-vol3-sec825-105.pdf, accessed August 2013).

have worked for the same employer for at least 12 months; (3) have worked at least 1250 hours in the previous 12 months before taking the leave under the FMLA; and (4) work in the United States, or in any territory or possession of the United States, where the employer has at least 50 employees within 75 miles. As a result, FMLA covers only about 50 percent of the workers in the United States (U.S. Commission on Family and Medical Leave, 1996). In contrast, PFL grants up to six weeks of *partially paid* but not job-protected family leave annually to most working Californians for bonding with a new child or caring for a sick child, spouse, parent, or domestic partner (Appelbaum and Milkman, 2011).

Our study uses data from the two waves of the Infant Feeding Practices Study (IFPS): one is before and the other is after the PFL law took effect. We examine the change in breastfeeding practice between the two waves of IFPS for Californian women versus women of other states (excluding Alaska and Hawaii). In the following section, we provide an overview of California's PFL program, followed by Section 3 in which we describe the data and the regression model. Section 4 discusses our empirical findings, and Section 5 is the conclusion.

2. California's paid family leave

California became the first state in the nation to pass a PFL law when it was enacted on September 23, 2002, although it was not the first state to introduce paid family leave legislation.[5] Passing the PFL law was a hard-won battle in an election year. "It took a particular combination of raw political power, resources, organizing, consensus building, conflict and compromise, and a certain amount of luck to win the game" (Labor Project for Working Families, 2003).

California's PFL program is funded solely by a payroll tax on workers. It builds on the existing state disability insurance (SDI) program, which pays about half of a worker's wage for up to one year for an absence from work due to an illness or injury unrelated to their job.

California's PFL program took effect on July 1, 2004. Employees covered by SDI are also covered by PFL. Nearly all working Californians are covered by SDI, and both SDI and PFL are fully employee-funded (Appelbaum and Milkman, 2011). Eligibility for SDI and PFL is similar. Neither requires a minimum number of hours worked. Instead, SDI eligibility requires an individual to be employed or actively seeking employment at the time he or she becomes disabled. Likewise, PFL eligibility requires an individual to be employed or actively looking for work at the time his or her family leave begins. Both SDI eligibility and PFL eligibility require an individual to have earned at least $300 from which SDI deductions were withheld during a previous period. Both full-time and part-time workers can be eligible for SDI and PFL.[6] The income from SDI benefits is exempted from federal income tax, but the income from PFL benefits is taxable. Before receiving PFL benefits, workers have to first wait a week of a nonpayable waiting period. In this situation, employers may require employees to use a two-week vacation leave (or paid time off), of which the first week will be applied to that waiting period.[7]

Under PFL, eligible workers receive up to six weeks of partially paid family leave to bond with a new child or to care for a sick family member. The PFL does not come with job protection; reinstatement and job retention rights are covered by preexisting laws, such as the FMLA or the California Family Rights Act (CFRA).[8] The PFL benefits replace 55 percent of one's weekly earnings, up to a maximum benefit (of $987 per week in 2011), which is indexed in relation to the state's average weekly wage (Appelbaum and Milkman, 2011). According to a 2007 report by the California Senate Office of Research (Sherriff, 2007), PFL is used primarily by working women and for bonding with a new child: 80 percent of PFL claims were filed by women, and nearly 90 percent of the claims were for bonding with newborns.

3. Data and methods

We use Waves I and II of the IFPS data collected by the Food and Drug Administration (FDA) and the CDC in collaboration with other federal agencies in 1993–94 and 2005–06, respectively. The infants in Wave I were born between February and October 1993; those in Wave II were born between June 2005 and March 2006. The start date of PFL benefits (July 1, 2004) falls between the two waves. Each wave collects longitudinal information about infant feeding practices and the diets of women from their third trimester (the seventh month of pregnancy) to 12 months postpartum. The two waves of IFPS are repeated cross sections: different women were surveyed in different waves.

The IFPS sample is drawn from a consumer opinion panel of half a million households living in the 48 contiguous states of the United States (Alaska and Hawaii excluded). The selection criteria are: (1) the mother is at least 18 years old at the time of the prenatal questionnaire; (2) the infant is full or nearly full-term and a singleton; (3) the mother and the infant are healthy at birth; and (4) the birth weight of the infant is at least five pounds. In each

[5] State senator Sheila Kuehl introduced Senate Bill (SB) 1661—the paid family leave legislation—in February 2002. By then, 19 other states had already introduced paid family leave legislation, but California was the only state that passed a law providing PFL during our sample period.

[6] Source: http://www.edd.ca.gov/Disability/DI_Eligibility.htm and http://www.edd.ca.gov/Disability/PFL_Eligibility.htm (accessed August 2013).

[7] Source: "Paid Family Leave Fact Sheet" available at http://www.edd.ca.gov/pdf_pub_ctr/de8714cf.pdf (accessed August 2013).

[8] For details, see "FAQs—Relation of the Paid Family Insurance program to the Family and Medical Leave Act (FMLA) and the California Family Rights Act (CFRA)" (Available at http://www.edd.ca.gov/disability/FAQ_PFL_and_FMLA_and_CFRA.htm, accessed November 2013). "To be eligible for CFRA leave, an employee must be either a full-time or part-time employee working in California, have more than 12 months (52 weeks) of service with the employer, have worked at least 1250 hours in the 12-month period before the date the leave begins, and work at a location in which the employer has at least 50 employees within 75 miles radius of the employee's work site." (Source: http://www.dfeh.ca.gov/Publications_CFRADefined.htm, accessed November 2013).

wave, the mother receives 11 mail-in questionnaires—one prenatal (during the third trimester of her pregnancy), one neonatal (mailed about three weeks after the childbirth), and nine postpartum (mailed approximately monthly throughout the infant's first year of life). The survey topics include breastfeeding, formula and complementary feeding, infant health, breast-pump use, and family characteristics. The samples of Waves I and II are nationally distributed, but not nationally representative. In general, respondents in both waves underrepresent households who have low socioeconomic status.

We use the following regression model to estimate the change in breastfeeding practice, represented by the parameter α_3, for Californian women:

$$y = \alpha_0 + \alpha_1 \mathrm{CA} + \alpha_2 \mathrm{Wave\,II} + \alpha_3 \mathrm{CA} \cdot \mathrm{Wave\,II} + \mathbf{x}'\alpha_4 + u.$$

Here, u is the mean zero disturbance term. The variable "y" is binary, equal to 1 for the occurrence of a certain breastfeeding outcome, such as the continuation of (exclusive) breastfeeding through critical thresholds, and 0 for the nonoccurrence. "CA" is a dummy variable equal to 1 if the respondent lives in California and 0 otherwise. "Wave II" is a dummy variable equal to 1 if the respondent is from Wave II of IFPS and 0 if from Wave I. In both equations, the vector "$\mathbf{x}$" includes characteristics of the mothers (e.g., age, race, marital status, and education attainment), their babies (e.g., gender and birth weight), the families (e.g., household size, household income, type of house, and home ownership), the population densities of residential areas, and the state-level unemployment rates at each wave.[9] We also include into the vector $\mathbf{x}$ a dummy variable indicating the presence (1) or absence (0) of a state law regarding breastfeeding support in the workplace.[10] In both equations, we control for state fixed effects for the 48 contiguous states. We estimate α's by ordinary least squares, with all standard errors clustered at the state level. Because of the sample size limitation, we lack sufficient statistical power to conduct subsample analysis by respondent's occupation.

4. Results and discussion

4.1. Descriptive statistics

Table 1 presents the summary statistics based on our estimation sample derived from the two waves of IFPS. The variable regarding the number of weeks of fully paid, partially paid, or unpaid leave that the woman is eligible for and can use as maternity leave comes directly from the survey question asked in the prenatal questionnaire sent to the woman when she was in the third trimester of pregnancy:

> "*Thinking of work leave that you can use for maternity leave, how many weeks are you eligible for if you have no complications? (Please write in the number of weeks of leave you are eligible for in each of the categories listed below. If you have no leave that you can use for maternity leave, write 0 in all: (a) weeks of fully paid leave; (b) weeks of partially paid leave; and (c) weeks of unpaid leave.*"[11]

The statistics in Table 1 suggest that nationwide, women were eligible for fewer maternity leaves in Wave II (2005–06) than in Wave I (1993), either fully paid, partially paid, or unpaid. Also, the proportions of women in Wave II who were eligible for fully paid, partially paid, and unpaid maternity leaves were lower than those in Wave I.[12] These declines seem to be consistent with the findings of three reports of the National Study of Employer (NSE). Specifically, the 2005 NSE report (Bond et al., 2005), which covers the time period closest to the one of our study, finds that from 1998 to 2005 women who receive disability payments due to childbirth are less likely to receive fully paid maternity leaves from their employers. The 2008 NSE report (Galinsky et al., 2008) also finds that from 1998 to 2008 employers become less likely to provide fully paid maternity leave, and the same pattern is confirmed in the 2012 NSE report (Matos and Galinsky, 2012) focusing on the period of 2005–2012. All three national studies of employers also find the declining trend to be in parallel with the reductions in employers' contribution to health care premiums in the period of 1998–2012.

As to breastfeeding practices, statistics in Table 1 indicate that women on average have longer breastfeeding durations between the two waves. For instance, in Waves I and II, approximately 64.6 percent and 74.2 percent, respectively, of respondents initiated breastfeeding; the

[9] We obtained state-level unemployment rates (as a percentage of labor force) from the Bureau of Labor Statistics. The first wave of IFPS covers infants born in 1993 and the second wave includes those born in 2005 and 2006. We take the seasonally adjusted December statistics in 1993 for the first wave, and the average of December statistics over 2005 and 2006 for the second wave. The 1993 unemployment data are available from Table 1 at http://www.bls.gov/news.release/history/laus_020294.txt (accessed August 2013); the 2005 and 2006 data are available from Table 3 at http://www.bls.gov/news.release/history/laus_01232007.txt (accessed August 2013).

[10] We compiled data on state laws related to breastfeeding using information from the National Conference of State Legislatures (available at http://www.ncsl.org/research/health/breastfeeding-state-laws.aspx, accessed August 2013). Between 1998 and 2006, 10 states in our sample passed state laws related to breastfeeding support in the workplace (Minnesota in 1998; Georgia and Tennessee in 1999; California, Connecticut, Illinois, and Washington in 2001; Virginia in 2002; Rhode Island in 2003; and Oklahoma in 2006). In general, these laws encourage or require employers to provide reasonable unpaid break time and appropriate space for an employee who needs to express breast milk for her nursing child. Similar federal law was not in place until 2010, which is outside our sample period.

[11] Source: http://www.cdc.gov/ifps/pdfs/IFPS_II/prenatal/prenantalfnlquest.pdf (accessed August 2013).

[12] In our sample period, New Jersey, New York, and Rhode Island have temporary disability programs (TDI) in place, which typically cover a period of 6–8 weeks after childbirth for women with partial wage replacement. (More discussions on TDI programs are given in Section 4.2.) We examine the changes in the numbers of weeks of fully paid and partially paid leave that the woman is eligible for and can use as maternity leave between the two waves for the following three cases: (1) between CA and non-CA states; (2) between the three TDI states (NJ, NY and RI) and the non-TDI states; and (3) between CA and the three TDI states. In all three cases, none of the changes are statistically significant. We also examine the same three cases for the changes in the proportions of women who are eligible for fully paid and partially paid leave that can be used as maternity leave between the two waves. Again, in all three cases we find none of the changes to be statistically significant.

Table 1
Summary statistics.

Variables	Wave I (birth year 1993, $N = 704$)		Wave II (birth year 2005–06, $N = 1324$)	
	Mean	Std. dev.	Mean	Std. dev.
Breastfeeding practices (1/0)				
Exclusive breastfeeding ≥ 3 months	12.6%	0.333	20.5%	0.404
Exclusive breastfeeding ≥ 6 months	1.3%	0.112	3.6%	0.186
Breastfeeding ≥ 3 months	43.9%	0.497	60.4%	0.489
Breastfeeding ≥ 6 months	27.6%	0.447	45.4%	0.498
Breastfeeding ≥ 9 months	17.9%	0.384	34.4%	0.475
Initiating exclusive breastfeeding	64.6%	0.479	74.2%	0.438
Neonatal exclusive breastfeeding	32.5%	0.469	39.7%	0.489
Mother's characteristics				
Number of weeks of fully paid leave that the woman is eligible for and can use as maternity leave	3.359	3.991	2.187	3.614
Number of weeks of partially paid leave that the woman is eligible for and can use as maternity leave	2.270	4.717	1.489	3.614
Number of weeks of unpaid leave that the woman is eligible for and can use as maternity leave	6.658	12.769	5.708	12.051
Whether a woman is eligible for fully paid leave that can be used as maternity leave (1/0)	54.1%	0.499	35.4%	0.478
Whether a woman is eligible for partially paid leave that can be used as maternity leave (1/0)	31.7%	0.466	21.8%	0.413
Whether a woman is eligible for unpaid leave that can be used as maternity leave (1/0)	56.3%	0.496	54.3%	0.498
Age	29.070	4.314	29.606	5.217
Other babies (1/0)	50.9%	0.500	61.5%	0.487
Married (1/0)	93.5%	0.247	77.3%	0.419
College (1/0)	76.7%	0.423	85.8%	0.349
White (1/0)	94.6%	0.226	87.2%	0.334
Black (1/0)	2.6%	0.158	4.5%	0.206
Asian (1/0)	0.3%	0.053	2.6%	0.158
Other (1/0)	1.7%	0.130	4.9%	0.216
Infant's characteristics				
Male (1/0)	50.3%	0.500	50.2%	0.500
Birth weight (in pounds)	7.808	1.036	7.644	1.050
Born in 2005 (1/0)	0	0	75.8%	0.429
Family characteristics				
Household size	3.622	1.023	3.024	1.159
Income-to-poverty line	389.281	213.865	305.634	197.878
Detached house (1/0)	74.6%	0.436	69.6%	0.460
Home owner (1/0)	74.1%	0.438	69.0%	0.463
Residential characteristics (1/0)				
Density-1	20.0%	0.400	17.7%	0.382
Density-2	8.7%	0.282	12.5%	0.331
Density-3	10.8%	0.311	10.2%	0.303
Density-4	11.8%	0.323	11.3%	0.316
Density-5	17.8%	0.382	13.1%	0.338
Density-6	6.1%	0.240	8.5%	0.278
Density-7	24.9%	0.432	26.7%	0.442
State-level variables				
Unemployment rate (%)	6.489	1.731	4.765	0.891
State laws regarding breastfeeding support in workplace (1/0)	0	0	26.0%	0.439

Note: Data are from Wave I (1993–94) and Wave II (2005–06) of Infant Feeding Practices Study (IFPS). The two waves of IFPS are repeated cross sections. The infants in Wave I were born between February and October 1993; those in Wave II were born between June 2005 and March 2006. The IFPS sample is drawn from a consumer opinion panel of half a million households living in the 48 contiguous states of the United States (Alaska and Hawaii excluded). The selection criteria are the following: (1) the mother is at least 18 years old at the time of the prenatal questionnaire; (2) the infant is full or nearly full-term and a singleton; (3) the mother and the infant are healthy at birth; and (4) the birth weight of the infant is at least five pounds. Descriptions and definitions of variables are provided in the Appendix Table A1. The reported sample size is based on the sample used for the estimations of exclusive breastfeeding through the first three months.

Table 2
Breastfeeding prevalence—CA vs. non-CA and Wave I vs. Wave II.

	Wave I	Wave II	Wave II minus Wave I difference
Panel A: exclusive breastfeeding for at least three months or not (1/0); N = 2028			
California	20.0%	33.0%	13%**
Other states	11.8%	19.5%	7.7%***
CA minus non-CA difference	8.2%*	13.5%***	Difference-in-differences = 5.3%
Panel B: exclusive breastfeeding for at least six months or not (1/0); N = 2017			
California	2.9%	9.3%	6.4%**
Other states	1.1%	3.1%	2%**
CA minus non-CA difference	1.8%	6.2%***	Difference-in-differences = 4.4%*
Panel C: breastfeeding for at least three months or not (1/0); N = 1988			
California	47.1%	78.4%	31.3%***
Other states	43.5%	59.0%	15.5%***
CA minus non-CA difference	3.6%	19.4%***	Difference-in-differences = 15.8%**
Panel D: breastfeeding for at least six months or not (1/0); N = 1929			
California	28.6%	62.6%	34.0%***
Other states	27.4%	44.0%	16.6%***
CA minus non-CA difference	1.2%	18.6%***	Difference-in-differences = 17.4%**
Panel E: breastfeeding for at least nine months or not (1/0); N = 1900			
California	17.1%	50.6%	33.5%***
Other states	18.0%	33.1%	15.1%***
CA minus non-CA difference	−0.9%	17.5%***	Difference-in-differences = 18.4%**

Note: Data are from Wave I (1993–94) and Wave II (2005–06) of Infant Feeding Practices Study (IFPS). Descriptions and definitions of variables are provided in the Appendix Table A1. The "difference-in-differences" is calculated by either of the two ways: (1) CA's "Wave II minus Wave I difference" minus non-CA's "Wave II minus Wave I difference"; (2) Wave II's "CA minus non-CA difference" minus Wave I's "CA minus non-CA difference." To test whether or not the difference in the means and the "difference-in-differences" are statistically significant, we regress each breastfeeding outcome on an intercept, the CA dummy, the Wave II dummy, and the "CA × Wave II" dummy (an interaction of the two dummy variables). The coefficient of the CA dummy indicates the "CA minus non-CA difference" in Wave I. The coefficient of the Wave II dummy indicates the "Wave II minus Wave I difference" of non-CA states. The coefficient of the "CA × Wave II" dummy indicates the "difference-in-differences." The sum of the CA coefficient and the "CA × Wave II" coefficient indicates the "CA minus non-CA difference" in Wave II. The sum of the Wave II coefficient and the "CA × Wave II" coefficient indicates the "Wave II minus Wave I difference" of California. Standard errors (not reported) are clustered by state.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

increased percentage could reflect a role of rising awareness of the benefits of breastfeeding. The rate of exclusive breastfeeding through the first three months rises from 12.6 to 20.5 percent, and through the first six months from 1.3 to 3.6 percent.[13] The nationwide increase in the breastfeeding rate is also consistent with the increasing availability and popularity of electric-powered, vacuum-operated breast pumps during the two waves. Compared with manual breast pumps, the electric ones make expressing milk easier and substantially more quickly, which will give lactating mothers more flexibilities of expressing their milk at a preferred time, storing the milk, and then feeding it to their babies at a later time.[14]

Both working and unemployed women (most of whom are full-time homemakers) are the IFPS target population. Because PFL applies only to working Californians, we focus on women who worked for pay from the three months before they became pregnant to the time when they received the IFPS prenatal questionnaire (in their third trimester).[15] This subgroup accounts for approximately 72 percent and 66 percent of the total respondents in IFPS I and II, respectively (not shown in Table 1). In both waves, this subgroup is more highly educated, with higher household income and fewer other children than the rest of the IFPS respondents. As for breastfeeding outcomes, only the breastfeeding initiation rates are roughly the same between this subgroup and other respondents. All other measures (including rates of exclusive and nonexclusive breastfeeding at different months of infant age) are lower for this subgroup than for the rest of the women of IFPS. Despite these differences, it is important to analyze the breastfeeding practices of this subgroup, which constitutes a critical component for meeting the breastfeeding goals of *Healthy People 2010* and *Healthy People 2020*.

In Table 2, we report the actual percentages of exclusive breastfeeding through the first three and six months, and

[13] Note that these rates of exclusive breastfeeding through the first three and six months are much lower than the estimates of national averages (36.0 and 16.3 percent, respectively) based on the CDC's National Immunization Survey (NIS) among infants born in 2009 (Breastfeeding Report Card, 2012). The differences could be explained by the different samples and survey methods used by NIS and IFPS. The NIS uses a nationally representative telephone survey in which responses to breastfeeding questions are retrospective. In contrast, IFPS uses mail-in questionnaires to collect detailed infant feeding information throughout the first year of an infant's life and asks (on the questionnaires) whether mothers are still breastfeeding. Because IFPS asks about current practice, not behaviors in retrospect, and uses mail-in surveys instead of phone interviews, the errors in measuring breastfeeding practice in IFPS could be significantly smaller than in NIS.

[14] We thank one reviewer for pointing out this alternative explanation regarding the use of breast pumps.

[15] In the IFPS data, the employment status (e.g., full time or part time) is not measured at the time when the mother starts taking her PFL, but during her pregnancy, specifically, from the three months before she became pregnant to the time when she received the IFPS prenatal questionnaire (in her third trimester).

Table 3
Exclusive breastfeeding outcomes.

	(1)	(2)	(3)
Panel A: exclusive breastfeeding for at least three months or not (1/0)			
CA × Wave II	0.079**	0.068	0.040
	(0.039)	(0.052)	(0.052)
Wave II	0.115***	0.112***	0.127***
	(0.034)	(0.036)	(0.035)
Sample size	2028	2028	1844
Other control variables	Y	Y	Y
State fixed effect	Y	Y	Y
State laws regarding breastfeeding support in workplace	N	Y	Y
Three TDI states excluded	N	N	Y
Panel B: exclusive breastfeeding for at least six months or not (1/0)			
CA × Wave II	0.051***	0.048**	0.038*
	(0.015)	(0.023)	(0.023)
Wave II	0.027*	0.026*	0.029*
	(0.015)	(0.015)	(0.016)
Sample size	2017	2017	1833
Other control variables	Y	Y	Y
State fixed effect	Y	Y	Y
State laws regarding breastfeeding support in workplace	N	Y	Y
Three TDI states excluded	N	N	Y

Note: Data are from Wave I (1993–94) and Wave II (2005–06) of Infant Feeding Practices Study (IFPS). Descriptions and definitions of variables are provided in the Appendix Table A1. Other control variables include "Wave II", "age", "other babies", "married", "college", "White", "Black", "Asian", "male", "birth weight", "born in 2005", "household size", "income-to-poverty line", "detached house", "home owner", "density-2" through "density-7", and the state-level unemployment rate. The three TDI states are NJ, NY and RI. Standard errors (in parenthesis) are clustered by state.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

the percentages of breastfeeding through the first three, six, and nine months. These percentages were calculated for four cases based on the combination of these two cases: whether a woman is in California (or in other states) and whether a woman is a Wave II (or a Wave I) IFPS respondent. In this table, we also report the "Wave II minus Wave I difference," the "CA minus non-CA difference," and the difference in these two differences. Consistent with the finding in Table 1, Table 2 shows that breastfeeding practices improved between the two waves, not only in California but in other states as well. Table 2 also shows that the gap in breastfeeding practice between California and other states widened between the two waves, especially for breastfeeding through the first three, six, and nine months. Furthermore, the difference-in-differences (DID) calculation shows that the improvement in breastfeeding practices between the two waves is more substantive in California than in other states. Specifically, there appears to be an increase of 5.3 percentage points (not statistically significant) for exclusive breastfeeding through the first three months, and 4.4 percentage points (significant at the 10% level) for exclusive through the first six months; concerning breastfeeding through the first three, six, and nine months, the increases are 15.8, 17.4, and 18.4 percentage points (all three increases being significant at the 5% level). Next, we use regression analysis to adjust for the effects of other covariates.

4.2. Results

Tables 3 and 4 present the estimates of α_2 and α_3 of the regression model for several breastfeeding practices using various specifications. Overall, the estimates of α_2 indicate that across the country breastfeeding practices improved between the two waves of IFPS, which is consistent with the findings in Tables 1 and 2. The estimates of α_3 indicate an increase in the duration of breastfeeding specific for Californian women between the two waves of IFPS. For exclusive breastfeeding, the increase emerges at the third-month marker (Panel A of Table 3) and becomes salient at the sixth-month marker, with a magnitude of 3–5 percentage points (Panel B of Table 3). For breastfeeding (exclusive or nonexclusive), the increase is much higher (Table 4), with the magnitude around 10–20 percentage points, which is consistent with the fact that nonexclusive breastfeeding is less challenging to sustain than exclusive breastfeeding.[16] In Table 4, we also note that the

[16] To establish and sustain exclusive breastfeeding, the World Health Organization and the United Nations Children's Fund recommend the following: (1) initiating breastfeeding within the first hour of life; (2) breastfeeding exclusively—no other food, drink, or water; (3) breastfeeding on demand—to feed as often as the infant wants, all day and all night long; and (4) not using bottles, teats, or pacifiers (http://www.who.int/nutrition/topics/exclusive_breastfeeding/en/index.html, accessed August 2013). These recommendations ask mothers to essentially be "glued" to the newborns, who usually need feeding every two or three hours in the first month. Therefore, in most cases it could only be possible for mothers to establish exclusive breastfeeding if they can take a postpartum maternity leave for at least a few weeks.

Table 4
Breastfeeding outcomes.

	(1)	(2)	(3)
Panel A: breastfeeding for at least three months or not (1/0)			
CA × Wave II	0.132***	0.124*	0.107
	(0.049)	(0.070)	(0.069)
Wave II	0.121***	0.119**	0.103**
	(0.046)	(0.047)	(0.048)
Sample size	1988	1988	1808
Other control variables	Y	Y	Y
State fixed effect	Y	Y	Y
State laws regarding breastfeeding support in workplace	N	Y	Y
Three TDI states excluded	N	N	Y
Panel B: breastfeeding for at least six months or not (1/0)			
CA × Wave II	0.215***	0.218***	0.218***
	(0.034)	(0.053)	(0.055)
Wave II	0.164***	0.164***	0.158***
	(0.045)	(0.044)	(0.045)
Sample size	1929	1929	1752
Other control variables	Y	Y	Y
State fixed effect	Y	Y	Y
State laws regarding breastfeeding support in workplace	N	Y	Y
Three TDI states excluded	N	N	Y
Panel C: breastfeeding for at least nine months or not (1/0)			
CA × Wave II	0.192***	0.211***	0.181***
	(0.053)	(0.064)	(0.059)
Wave II	0.132***	0.137***	0.132***
	(0.040)	(0.043)	(0.041)
Sample size	1900	1900	1724
Other control variables	Y	Y	Y
State fixed effect	Y	Y	Y
State laws regarding breastfeeding support in workplace	N	Y	Y
Three TDI states excluded	N	N	Y

Note: Data are from Wave I (1993–94) and Wave II (2005–06) of Infant Feeding Practices Study (IFPS). Descriptions and definitions of variables are provided in the Appendix Table A1. Other control variables include "Wave II", "age", "other babies", "married", "college", "White", "Black", "Asian", "male", "birth weight", "born in 2005", "household size", "income-to-poverty line", "detached house", "home owner", "density-2" through "density-7", and the state-level unemployment rate. The three TDI states are NJ, NY and RI. Standard errors (in parenthesis) are clustered by state.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

magnitude of increase jumps significantly between the third- and sixth-month threshold, and then becomes roughly stable between the sixth- and ninth-month threshold.[17] This pattern suggests that the sustainability of breastfeeding is most difficult to achieve at the early stage because the mother has to adapt to the schedule of supplying breast milk while her body is adjusting to lactation.

In our sample, four states—California, New Jersey, New York, and Rhode Island—have temporary disability insurance (TDI) programs in place.[18] California's PFL program is an extended version of the state's TDI program (which is called SDI in California). TDI benefits usually consist of a specific percentage of wage replacement up to a maximum weekly dollar cap. TDIs are either entirely employee-financed or financed through employer and employee contributions. These state TDIs have covered pregnancy since the passage of the Pregnancy Discrimination Act (1978). The typical period covered by TDI related to a pregnancy is six weeks after a vaginal delivery or eight weeks following a cesarean delivery. As a result, TDI programs could play important roles in helping women to continue their breastfeeding practices through critical thresholds, such as the third and sixth month after childbirth. To check the robustness of the estimates, we

[17] Table 4 reports the results for the following three outcomes: breastfeeding through the first three, six, and nine months. According to the IFPS II Data Handbook (p. 29, available upon request at ifps@cdc.gov), the missing values of the breastfeeding duration variable are imputed using the midpoint of: (a) infant age on the last questionnaire in which the mother indicated breastfeeding; and (b) infant age on the first questionnaire in which she indicated that she had stopped breastfeeding and pumping milk. Because the 12-month postpartum survey is the last one, there will be no information on (b) needed for the imputation. Thus, the missing values in the 12-month postpartum survey cannot be imputed in the same way as in the previous surveys. Because of this inconsistency, we do not examine the occurrence of breastfeeding through the first 12 months.

[18] California passed the SDI law in 1946; Rhode Island passed their TDI law in 1942, New Jersey in 1948, New York in 1949, Puerto Rico in 1968, and Hawaii in 1969.

Table 5
Other breastfeeding outcomes.

	(1)	(2)	(3)
Panel A: initiating exclusive breastfeeding or not (1/0)			
CA × Wave II	−0.007	−0.035	−0.042
	(0.053)	(0.068)	(0.073)
Wave II	0.128***	0.121***	0.116**
	(0.045)	(0.045)	(0.046)
Sample size	1847	1847	1689
Other control variables	Y	Y	Y
State fixed effect	Y	Y	Y
State laws regarding breastfeeding support in workplace	N	Y	Y
Three TDI states excluded	N	N	Y
Panel B: neonatal exclusive breastfeeding or not (1/0)			
CA × Wave II	0.062	0.014	−0.005
	(0.052)	(0.078)	(0.079)
Wave II	0.131***	0.118***	0.128***
	(0.044)	(0.044)	(0.042)
Sample size	2040	2040	1856
Other control variables	Y	Y	Y
State fixed effect	Y	Y	Y
State laws regarding breastfeeding support in workplace	N	Y	Y
Three TDI states excluded	N	N	Y

Note: Data are from Wave I (1993–94) and Wave II (2005–06) of Infant Feeding Practices Study (IFPS). Descriptions and definitions of variables are provided in the Appendix Table A1. Other control variables include "Wave II", "age", "other babies", "married", "college", "White", "Black", "Asian", "male", "birth weight", "born in 2005", "household size", "income-to-poverty line", "detached house", "home owner", "density-2" through "density-7", and the state-level unemployment rate. The three TDI states are NJ, NY and RI. Standard errors (in parenthesis) are clustered by state.

** Significant at the 5% level.

*** Significant at the 1% level.

further drop three states—New Jersey, New York, and Rhode Island—from the estimation sample because these states have TDI programs that provide partial wage replacement for 6–8 weeks after childbirth.[19] The results are reported in column (3) of Tables 3 and 4, which confirm the same pattern shown in columns (1) and (2).

Next, we check an alternative explanation based on the National Breastfeeding Awareness Campaign (NBAC), which is a three-year campaign designed to promote breastfeeding among first-time parents. The NBAC was launched by the U.S. Department of Health and Human Services in June 2004, and it occurred between the two waves of IFPS. Our previous results show that breastfeeding practices improved across the country between the two waves of IFPS. It is possible that the improvement in California is due to a more intensively conducted NBAC in California. To check for this possibility, we examine in Table 5 the coefficients of the variable "CA × Wave II" of our regression model for the occurrences of the following two outcomes, respectively: (1) initiating exclusive breastfeeding when the baby left the hospital or the birth center; and (2) breastfeeding the baby exclusively in the neonatal period (i.e., the first month after birth). If the NBAC was conducted more intensively in California during Wave II, then we would expect significant effects of the variable "CA × Wave II" on one or both of the outcomes. This is because, unlike exclusive or nonexclusive breastfeeding throughout a longer period (e.g., the first three or six months), the initiation and continuation of exclusive breastfeeding within the first month after birth is more related to the awareness of breastfeeding benefits, which is what the NBAC focuses on, rather than the (opportunity) costs of breastfeeding.

In all columns of Table 5, we do not find any statistically significant coefficient of the "CA × Wave II" variable. This is consistent with actual breastfeeding practices. In a world with perfect foresight, initial and neonatal breastfeeding would be optimal decisions made by a mother who takes all the costs and benefits of breastfeeding into account. But, initial and neonatal breastfeeding are idiosyncratic experiences that differ with each individual, and even across different births of the same woman; the difficulties of

[19] We do not have the data that allow us to separate the proportion of partially paid leave due to California's PFL from that of the state's TDI program. Nonetheless, in Appendix Table A2 we report the results on the possibility that the TDI (which is called SDI in California) program adopted by California fully explains the improvement of breastfeeding practices. To do so, we drop California from our estimation sample and replace the "CA" dummy variable in our regression model with a "TDI" dummy variable equal to 1 for the three states with TDI programs in place (New Jersey, New York, and Rhode Island). In fact, there are five states—California, Hawaii, New Jersey, New York, and Rhode Island—plus Puerto Rico that have their own versions of TDI programs. We do not have IFPS data for Hawaii and Puerto Rico. Our use of the three TDI states (New Jersey, New York, and Rhode Island) as a proxy for California is not ideal. Nevertheless, results reported in Appendix Table A2 provide some evidence against the explanation of attributing improved breastfeeding practice to TDI. For all three cases of breastfeeding through important markers (Panels A, B, and C), we do not find any statistically significant changes in breastfeeding outcomes for the TDI states between the two waves of IFPS, which is also consistent with the fact that there were no policy changes regarding TDI benefits related to pregnancy and childbirth in these states during our sample period. The insignificant TDI effects could also be driven by male-dominated professions. For example, people employed in the railroad industry are eligible for TDI and they are likely to be male. But, it is women who breastfeed their babies.

initial and neonatal breastfeeding are impossible to anticipate by new (or even experienced) mothers. Therefore, we argue that initial and neonatal breastfeeding reflect more about the mothers' awareness of the benefits of breastfeeding than the constraints of available maternity leaves, given that in most cases women immediately after childbirth rest at the hospital or at home for a few days.

Furthermore, whether having ever breastfed the baby essentially depends on breastfeeding initiation, because a mother cannot resume breastfeeding once she stops it. Therefore, breastfeeding initiation is of high option value to mothers whether they eventually pursue long-term breastfeeding. Thus, breastfeeding initiation largely reflects the combined effect of a mother's awareness of the benefits of breastfeeding, the assistance from physicians and nurses the mother receives at the hospital or the birth center, the health of the mother immediately after labor, and the health of the infant at birth. Overall, the results in Table 5 suggest that the improvement in breastfeeding practices in California is unlikely to be a result of the NBAC being more intensively conducted in that state, although the NBAC is likely to have contributed to the nationwide improvement in breastfeeding practices between the two waves of IFPS, which is reflected in the summary statistics (in Tables 1 and 2) and the estimates of α_2 (the coefficient of "Wave II" in Tables 3–5).

4.3. Limitations

The passage of California's PFL was the result of a hard-won battle in an election year. The bill initially proposed up to 12 weeks of partially paid family leave with the cost evenly split between employers and employees. But the business community strongly opposed the employer contribution. The supporting coalition compromised by cutting the benefit period in half and dropping the employer contribution just before the bill went to the Assembly floor. The Assembly and Senate passed the amended bill at the end of August 2002. However, for nearly a month, Governor Gray Davis did not give any indication of whether he would sign or veto the bill. PFL had not been tested in other states, and the governor was known for being risk-averse. Besides, the governor was up for reelection and was in an unexpectedly tight race. Although the bill could obtain support from women and labor unions, it also could incense corporate donors. Under intensified pressure from the supporting coalition, the governor signed the bill on September 23, 2002, which made California's PFL a reality earlier than its advocates had hoped (Labor Project for Working Families, 2003).

From a researcher's perspective, the passage of the PFL law was almost like a random assignment under California's political climate in that particular election year: no one was certain about the fate of the bill until Gov. Davis signed the bill. Furthermore, PFL in itself does not seek to directly affect breastfeeding practice, but only expands family leave benefits. Thus, it is possible that PFL would have an effect on breastfeeding through its effect on leave-taking behaviors. In other words, PFL encourages the use of maternity leave, but it does not directly affect breastfeeding practices. Therefore, changes in breastfeeding practices following the implementation of PFL could suggest a role of partially paid maternity leave. However, we are unable to examine the direct effect of leave-taking under the PFL on breastfeeding practice because of our data limitations.

First, we lack the data on the length of the maternity leave actually taken after childbirth, and the proportion of those leaves that were fully paid, partially paid, and unpaid. Although we have the data collected before childbirth on the numbers of weeks of fully paid, partially paid, and unpaid leaves that a woman is eligible for and can use as maternity leaves, these data are insufficient for us to examine the role of having access to partially compensated maternity leave in raising the likelihood of breastfeeding at several important markers of early infancy. One problem is that the leave-taking eligibility is self-reported before childbirth, which does not necessarily correspond to actual leaving-taking behaviors in the postpartum period. Furthermore, although our data allow us to find an increase in the numbers of weeks of partially paid leave that a woman is eligible for and can use as maternity leave, we do not have the information to identify whether the increase is due to PFL, SDI, or both. In fact, PFL can be used in addition to SDI and therefore has significant benefits.[20]

Second, the time lag (12–13 years) between the two waves of IFPS is too large to justify a case that California and other states experienced similar changes over time except that PFL occurred in California. Indeed, we find significant demographic changes in California relative to other states (Alaska and Hawaii excluded) and report the estimates in Table 6: between the two waves of IFPS, there was an increase in the Asian population, and declines in the White population, in the number of children born, and in home ownership.[21] Although we control for all the variables listed in Table 6 in our regression model, there is no compelling reason to believe we have effectively controlled for all important differential changes other than the PFL change in California relative to other states. For example, during our sample period there was a significant increase in Latino immigrant mothers in California, and Latino immigrants are perhaps more likely to breastfeed and to breastfeed longer than U.S.-born Mexican Americans, Blacks, or Asians.[22]

Third, even if we have data on maternity leave actually taken, we still have a sample selection bias. The infants selected for IFPS were healthier and born to mothers who are more likely to be white, older, better educated, and having higher income than the general U.S. population (Fein et al., 2008; Roe et al., 1999). On the one hand, mothers with higher socioeconomic status may be more likely to breastfeed their babies because of their better

[20] For example, the SDI program generally provides a new mother with the benefits of four weeks before and six to eight weeks after childbirth. After the completion of her pregnancy claim, she may then file for a paid family leave for bonding with the newborn.

[21] The standard errors in Table 6 are robust to heteroskedasticity, which in theory may be smaller than the clustered standard errors. We err on the side of caution of not inflating standard errors to make fewer results being statistically significant.

[22] We thank one reviewer for pointing this out to us.

Table 6
Changes in individual-level observable characteristics between Waves I and II.

Variables	(1) Age	(2) Other babies	(3) Married	(4) College	(5) White	(6) Black	(7) Asian
CA × Wave II	−0.195	−0.131**	0.028	0.051	−0.137***	0.007	0.068***
	(0.611)	(0.059)	(0.043)	(0.049)	(0.043)	(0.016)	(0.023)
Sample size	4575	4454	4129	4115	4581	4581	4581

Variables	(8) Male	(9) Birth weight	(10) Household size	(11) Income-to-poverty line	(12) Detached house	(13) Home owner
CA × Wave II	0.062	0.054	−0.124	−33.002	−0.034	−0.107*
	(0.066)	(0.135)	(0.133)	(25.209)	(0.056)	(0.056)
Sample size	3249	3605	4577	4577	4579	4576

Note: Data are from Wave I (1993–94) and Wave II (2005–06) of Infant Feeding Practices Study (IFPS). Descriptions and definitions of variables are provided in the Appendix Table A1. Each variable of columns (1)–(13) is regressed on an intercept, a dummy variable indicating Wave II, an interaction term between the Wave II dummy variable and the CA dummy variable, and state dummy variables. Robust standard errors are reported in parentheses.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

access to generous maternity leaves or greater awareness of the benefits of breastfeeding.[23] In this case we can overestimate the actual effect of maternity leave on breastfeeding based on the IFPS sample. On the other hand, if women with higher socioeconomic status (e.g., the respondents of IFPS) have higher opportunity costs for taking full maternity leave, then the actual effect of maternity leave on breastfeeding may be underestimated.

Fourth, we are unable to explore another alternative hypothesis because of the data limitation. The IFPS data do not have the information on paternity leave. Note that fathers in California can use PFL for paternity leave. If fathers who are on paternity leave take over more household chores, then their work could make it easier for mothers to continue breastfeeding.[24]

5. Conclusion

The United States has not met the national breastfeeding goals of *Healthy People 2020*, especially in the rates of exclusive breastfeeding throughout the first three and six months, two critical markers of early infancy. One primary reason for early weaning is that the mother has to return to work. Although the 1993 FMLA entitles eligible workers to a maximum of 12 weeks of job-protected leave that can be used for maternity leave, many who need the leave do not take it. The limited use of family leave provided by FMLA arises from its limited coverage and the fact that the leave is unpaid. Today, more than 50 percent of mothers with infants less than a year old participate in the labor force (Cohany and Sok, 2007).[25] They face the tension between working and breastfeeding. Indeed, the arrival of a child may be bittersweet for parents. With unpaid leave, mothers often struggle with the desire to breastfeed and nurture the newborn at home versus the need to return to work to support the family.

Using the two waves of IFPS data, we provide evidence on the improvement of breastfeeding practices in California after the state implemented the nation's first PFL program: an increase of 3–5 percentage points for exclusive breastfeeding through the first three and six months, and an increase of 10–20 percentage points for breastfeeding through the first three, six, and nine months. Our findings support the Surgeon General's call for paid leave policies to promote breastfeeding. One important aspect of breastfeeding that urgently needs attention and that has not been thoroughly studied is direct breastfeeding, as opposed to feeding with breast milk from a bottle.[26] However, we are unable to investigate these breastfeeding practices separately because of the limitations of our data. The IFPS data provide information on the frequencies of foods (e.g., breast milk, infant formula, or sugar water), but not on food delivery. Thus, we are unable to tell the two breastfeeding practices apart using our IFPS data.

Direct breastfeeding could confer significant health benefits that bottle-feeding lacks: both practices provide breast milk, but bottle-feeding lacks the unique process of nursing that direct breastfeeding offers. For the promotion of direct breastfeeding, it is necessary to provide sufficient maternity leave. For instance, when a mother returns to her workplace, she may have to leave her baby at home and the baby may have to be fed from a bottle. This situation

[23] Rossin (2011) finds that maternity leave expanded by the FMLA, even though unpaid, can lead to better infant birth outcomes such as increases in birth weight and decreases in the likelihoods of a premature birth and infant death for those born to college-educated and married mothers. Han et al. (2008) find that women who are married, with a Bachelor's degree or higher, and aged 30 or older are more likely to take longer maternity leaves.

[24] We thank one reviewer for pointing out this alternative hypothesis regarding the use of paternity leave.

[25] The labor force participation rate for mothers with infants under a year old was still kept at 57 percent in 2012 (Bureau of Labor Statistics, April 2013, http://www.bls.gov/news.release/famee.nr0.htm, accessed November 2013).

[26] We thank one reviewer for pointing out this important aspect of breastfeeding.

can cause "nipple confusion"—the baby may refuse the mother's nipples and thus can only be fed through bottles. Nipple confusion can make it harder for a mother to continue breastfeeding, which can in turn lead to a decrease or even cessation of the mother's milk supply.

To bring breastfeeding rates closer to public health goals, we need both education that emphasizes breastfeeding benefits, and workplace support (such as PFL) that reduces job-related obstacles. Between the two waves of IFPS, there was a dramatic increase in breastfeeding initiation rates, thanks at least in part to the NBAC, launched in June 2004. Although approximately 74.2 percent of the respondents in the second wave of IFPS initiated breastfeeding, only about 3.6 percent of the Wave II respondents breastfed their infants exclusively till the sixth month, a threshold recommended by the American Academy of Pediatrics. That contrast underscores the need to deal with work-related obstacles or (opportunity) costs to the continuation of breastfeeding practices.

Breastfeeding has many health benefits, for both infants and their mothers, which represents societal gain. However, the private sector may not fully internalize these social benefits and not provide sufficient support. In fact, only 8 percent of U.S. workers in the private sector in 2007 had access to paid family leave to care for their newborns (U.S. Bureau of Labor Statistics, 2007). Despite the fact that PFL in California grants only partially paid family leave, we find that it could potentially promote breastfeeding by raising the rates of breastfeeding through several of the thresholds noted in public health goals. In this regard, FMLA has not been effective. By providing partial wage replacement, PFL could make maternity leave more affordable to working mothers. In a study focusing on a nationally representative sample and during 1999–2010, Rossin-Slater et al. (2013) find that California's PFL program increases the overall use of maternity leave from an average of three to six weeks, with particularly large increases for non-college-educated, unmarried, Black, and Hispanic mothers. Their study also finds that PFL could increase the usual weekly work hours, by 10–17%, of mothers who are employed and who have children under three years old, and their wage income could also increase by a similar amount.

California's PFL has minimal cost to employers, because PFL benefits are funded completely by employees' contribution. Moreover, PFL is potentially beneficial to employers, because it reduces employees' turnover and improves their morale (Appelbaum and Milkman, 2011). Therefore, California's PFL could set up a useful model for other states. New Jersey implemented its own PFL program in 2009. Other states that have considered PFL programs include Arizona, Illinois, Maine, Massachusetts, Missouri, New Hampshire, New York, Oregon, and Pennsylvania (Appelbaum and Milkman, 2011). PFL legislations in California and New Jersey seem to be steps ahead in attaining these socially desirable breastfeeding goals.

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Appendix A

See Tables A1 and A2.

Table A1
Descriptions and definitions of variables.

Variables	Descriptions and definitions
Breastfeeding practices	
Duration (in weeks) of exclusive breastfeeding	This variable is provided in IFPS II. According to IFPS II Data Handbook (p. 28, available upon request at ifps@cdc.gov), its value is estimated using the midpoint of: (1) infant age on the last questionnaire in which the mother indicated exclusive breastfeeding; and (2) infant age on the first questionnaire in which she indicated that she was not exclusively breastfeeding any longer. For example, if she was exclusively breastfeeding on the Month-5 Questionnaire, which she completed at infant age 5.5 months, and was not exclusively breastfeeding on the Month-6 Questionnaire, which she completed at infant age 6.5 months, the duration of exclusive breastfeeding will be equal to the midpoint between these two ages (or 6 months). In IFPS II, this variable has a code of 77 if a mother had exclusively breastfed through the last questionnaire that she completed. We set this variable equal to the last age at which the infant is known to be exclusively breastfed if it takes the value of 77. Our approach follows the recommendation by IFPS II Data Handbook. This variable is not provided in IFPS I, and we construct this variable using the same method as we do for IFPS II. However, in IFPS I, infant ages at the Neonatal, Month-2, and Month-3 Questionnaires are in days, but infant ages at Questionnaires of the rest of months are in months. We convert infant ages into weeks, dividing the ages by 7 if they are in days or multiplying the ages by 365/84 if they are in months.
Exclusive breastfeeding $\geq$ 3 months	Equal to 1 if the duration of exclusive breastfeeding is greater than to equal to 12 weeks and 0 otherwise.
Exclusive breastfeeding $\geq$ 6 months	Equal to 1 if the duration of exclusive breastfeeding is greater than to equal to 24 weeks and 0 otherwise.

Table A1 (*Continued*)

Variables	Descriptions and definitions
Duration (in weeks) of breastfeeding	Breastfeeding duration was asked directly of the mother. This variable is provided by both IFPS I and II with missing values imputed. The imputation method is explained in IFPS II Data Handbook (p. 29, available upon request at ifps@cdc.gov). According to IFPS II Data Handbook (p. 29), the imputed value is the midpoint of: (1) infant age on the last questionnaire in which the mother indicated breastfeeding; and (2) infant age on the first questionnaire in which she indicated that she had stopped breastfeeding and pumping milk. In IFPS II, this variable has a code of 77 if a mother had breastfed through the last questionnaire that she completed. We set this variable equal to the last age at which the infant is known to be breastfed if it takes the value of 77. Our approach follows the recommendation by IFPS II Data Handbook. However, in IFPS I, infant ages at the Neonatal, Month-2, and Month-3 Questionnaires are in days, but infant ages at Questionnaires of the rest of months are in months. We convert infant ages into weeks, dividing the ages by 7 if they are in days or multiplying the ages by 365/84 if they are in months.
Breastfeeding $\geq$ 3 months	Equal to 1 if the duration of breastfeeding is greater than to equal to 12 weeks and 0 otherwise.
Breastfeeding $\geq$ 6 months	Equal to 1 if the duration of breastfeeding is greater than to equal to 24 weeks and 0 otherwise.
Breastfeeding $\geq$ 9 months	Equal to 1 if the duration of breastfeeding is greater than to equal to 36 weeks and 0 otherwise.
Neonatal exclusive breastfeeding	Equal to 1 if exclusive breastfeeding at the neonatal survey and 0 otherwise.
Initiating exclusive breastfeeding	Equal to 1 if the infant was breastfed only when left hospital or birth center; and 0 if the infant was fed with formula, or fed with both breast milk and formula, when left hospital or birth center. Each respondent was asked about this breastfeeding initiation question in the neonatal questionnaire.
Mother's characteristics	
Number of weeks of fully paid leave that the woman is eligible for and can use as maternity leave	This variable represents the weeks of fully paid maternity leave that the woman is eligible for and can use as maternity leave. This information is collected in the prenatal questionnaire, which was sent to the woman in her third trimester of pregnancy.
Number of weeks of partially paid leave that the woman is eligible for and can use as maternity leave	This variable represents the weeks of partially paid maternity leave that the woman is eligible for and can use as maternity leave. This information is collected in the prenatal questionnaire, which was sent to the woman in her third trimester of pregnancy.
Number of weeks of unpaid leave that the woman is eligible for and can use as maternity leave	This variable represents the weeks of unpaid maternity leave that the woman is eligible for and can use as maternity leave. This information is collected in the prenatal questionnaire, which was sent to the woman in her third trimester of pregnancy.
Whether a woman is eligible for fully paid leave that can be used as maternity leave (1/0)	Equal to 1 if the number of weeks of fully paid leave that the woman is eligible for and can use as maternity leave is greater than zero, and equal to 0 if the number of weeks of fully paid leave that the woman is eligible for and can use as maternity leave is zero.
Whether a woman is eligible for partially paid leave that can be used as maternity leave (1/0)	Equal to 1 if the number of weeks of partially paid leave that the woman is eligible for and can use as maternity leave is greater than zero, and equal to 0 if the number of weeks of partially paid leave that the woman is eligible for and can use as maternity leave is zero.
Whether a woman is eligible for unpaid leave that can be used as maternity leave (1/0)	Equal to 1 if the number of weeks of unpaid leave that the woman is eligible for and can use as maternity leave is greater than zero, and equal to 0 if the number of weeks of unpaid leave that the woman is eligible for and can use as maternity leave is zero.
Other babies	Equal to 1 if the respondent has one or more than one other babies and 0 otherwise.
Married	Equal to 1 if the respondent is married and 0 otherwise.
College	Equal to 1 if the respondent has 1–3 years of college education, or graduated from college, or has some postgraduate education; and 0 otherwise.
White	Equal to 1 if White and 0 otherwise.
Black	Equal to 1 if Black and 0 otherwise.
Asian	Equal to 1 if Asian/Pacific Islander and 0 otherwise.
Other	Equal to 1 if other race and 0 otherwise.
Infant's characteristics	
Male	Equal to 1 if male and 0 if female.
Birth weight	Measured in pounds.
Born in 2005	Equal to 1 if the infant was born in 2005 and 0 otherwise.
Household characteristics	
Income-to-poverty line	According to IFPS II Data Handbook (p. 27), this variable is the ratio of household income to the poverty thresholds by household size produced by the latest available data from the US Census Bureau. Because household income was collected in ranges by IFPS, the midpoint of each category is used for estimating the percent of poverty.
Detached house	Equal to 1 if the family home is detached from any other houses and 0 otherwise.
Home owner	Equal to 1 if homeowner and 0 otherwise.
Residential characteristics	
Density-1	Population density: equal to 1 if not Metropolitan Statistical Areas (MSA) and 0 otherwise.
Density-2	Population density: equal to 1 if Central city $<$ 0.5 million and 0 otherwise.
Density-3	Population density: equal to 1 if Non central city $<$ 0.5 million and 0 otherwise.
Density-4	Population density: equal to 1 if Central city 0.5–2 million and 0 otherwise.
Density-5	Population density: equal to 1 if Non central city 0.5–2 million and 0 otherwise.
Density-6	Population density: equal to 1 if Central city $>$ 2 million and 0 otherwise.
Density-7	Population density: equal to 1 if Non central city $>$ 2 million and 0 otherwise.

Note: Data are from Wave I (1993–94) and Wave II (2005–06) of Infant Feeding Practices Study (IFPS).

Table A2
Breastfeeding outcomes for non-California states.

	(1)	(2)
Panel A: breastfeeding for at least three months or not (1/0)		
TDI × Wave II	0.033	0.036
	(0.074)	(0.075)
Wave II	0.120**	0.117**
	(0.048)	(0.048)
Sample size	1821	1821
Other control variables	Y	Y
State fixed effect	Y	Y
State laws regarding breastfeeding support in workplace	N	Y
CA excluded	Y	Y
Panel B: breastfeeding for at least six months or not (1/0)		
TDI × Wave II	0.039	0.040
	(0.038)	(0.039)
Wave II	0.160***	0.160***
	(0.046)	(0.045)
Sample size	1768	1768
Other control variables	Y	Y
State fixed effect	Y	Y
State laws regarding breastfeeding support in workplace	N	Y
CA excluded	Y	Y
Panel C: breastfeeding for at least nine months or not (1/0)		
TDI × Wave II	−0.034	−0.041
	(0.067)	(0.068)
Wave II	0.145***	0.150***
	(0.040)	(0.042)
Sample size	1743	1743
Other control variables	Y	Y
State fixed effect	Y	Y
State laws regarding breastfeeding support in workplace	N	Y
CA excluded	Y	Y

Note: Data are from Wave I (1993–94) and Wave II (2005–06) of Infant Feeding Practices Study (IFPS). Descriptions and definitions of variables are provided in the Appendix Table A1. The dummy variable "TDI" equals 1 if the state is NJ, NY or RI; and 0 otherwise. Other control variables include "Wave II", "age", "other babies", "married", "college", "White", "Black", "Asian", "male", "birth weight", "born in 2005", "household size", "income-to-poverty line", "detached house", "home owner", "density-2" through "density-7", and the state-level unemployment rate. Standard errors (in parenthesis) are clustered by state.

** Significant at the 5% level.

*** Significant at the 1% level.

References

Appelbaum, E., Milkman, R., 2011. Leaves That Pay: Employer and Worker Experiences With Paid Family Leave in California. The Center for Economic and Policy Research. http://www.cepr.net/index.php/publications/reports/leaves-that-pay (accessed August 2013).

Baker, M., Milligan, K., 2008. Maternal employment, breastfeeding, and health: evidence from maternity leave mandates. Journal of Health Economics 27 (4) 871–887.

Bartick, M., Reinhold, A., 2010. The burden of suboptimal breastfeeding in the United States: a pediatric cost analysis. Pediatrics 125 (5) e1048–e1056.

Berger, L.M., Hill, J., Waldfogel, J., 2005. Maternity leave, early maternal employment and child health and development in the US. Economic Journal 115 (501) F29–F47.

Bond, J.T., Galinsky, E., Kim, S.S., Brownfield, E., 2005. National Study of Employers. Families and Work Institute. http://familiesandwork.org/site/research/reports/2005nse.pdf (accessed November 2013).

Breastfeeding Report Card, 2010. http://www.cdc.gov/breastfeeding/data/reportcard/reportcard2010.htm (accessed August 2013).

Breastfeeding Report Card, 2012. http://www.cdc.gov/breastfeeding/data/reportcard/reportcard2012.htm (accessed August 2013).

Brennan, L., McDonald, J., Shlomowitz, R., 2004. Infant feeding practices and chronic child malnutrition in the Indian States of Karnataka and Uttar Pradesh. Economics & Human Biology 2 (1) 139–158.

Calnen, G., 2010. The impact of maternity leave on breastfeeding rates. Breastfeeding Medicine 5, 233–234.

Cohany, S.R., Sok, E., 2007. Trends in labor force participation of married mothers of infants. Monthly Labor Review (February) 9–16.

Dustmann, C., Schönberg, U., 2012. Expansions in maternity leave coverage and children's long-term outcomes. American Economic Journal: Applied Economics 4 (3) 190–224.

Fass, S., 2009. Paid Leave in the States: A Critical Support for Low-Wage Workers and Their Families. Report National Center for Children in Poverty, New York. http://academiccommons.columbia.edu/catalog/ac:126284 (accessed August 2013).

Fein, S.B., Mandal, B., Roe, B.E., 2008. Success of strategies for combining employment and breastfeeding. Pediatrics 122 (Suppl. 2) S56–S62.

Fein, S.B., Roe, B., 1998. The effect of work status on initiation and duration of breast-feeding. American Journal of Public Health 88 (7) 1042–1046.

Galinsky, E., Bond, J.T., Sakai, K., Kim, S.S., Giuntoli, N., 2008. National Study of Employers. Families and Work Institute. http://familiesandwork.org/site/research/reports/2008nse.pdf (accessed November 2013).

Guendelman, S., Kosa, J.L., Pearl, M., Graham, S., Goodman, J., Kharrazi, M., 2009. Juggling work and breastfeeding: effects of maternity leave and occupational characteristics. Pediatrics 123 (1) e38–e46.

Haines, M.R., Kintner, H.J., 2008. Can breast feeding help you in later life? Evidence from German military heights in the early 20th century. Economics & Human Biology 6 (3) 420–430.

Hanratty, M., Trzcinski, E., 2009. Who benefits from paid family leave? Impact of expansions in Canadian paid family leave on maternal employment and transfer income. Journal of Population Economics 22 (3) 693–711.

Han, W.-J., Ruhm, C.J., Waldfogel, J., Washbrook, E., 2008. The timing of mothers' employment after childbirth. Monthly Labor Review 131 (6) 15–27.

Ip, S., Chung, M., Raman, G., Chew, P., Magula, N., DeVine, D., Trikalinos, T., Lau, J., 2007. Breastfeeding and Maternal and Infant Health Outcomes in Developed Countries. Evidence Report/Technology Assessment No. 153 (Prepared by Tufts-New England Medical Center Evidence-Based Practice Center, under Contract No. 290-02-0022). AHRQ Publication No. 07-E007 Agency for Healthcare Research and Quality (AHRQ), Rockville, MD.

Kimbro, R.T., 2006. On-the-job Moms: work and breastfeeding initiation and duration for a sample of low-income women. Maternal and Child Health Journal 10 (1) 19–26.

Komlos, J., Baur, M., 2004. From the tallest to (one of) the fattest: the enigmatic fate of the American population in the 20th century. Economics & Human Biology 2 (1) 57–74.

Kurinij, N., Shiono, P.H., Ezrine, S.F., Rhoads, G.G., 1989. Does maternal employment affect breast-feeding? American Journal of Public Health 79 (9) 1247–1250.

Labor Project for Working Families, 2003. Putting Families First: How California Won The Fight For Paid Family Leave. Labor Project for Working Families.

Lalive, R., Zweimüller, J., 2009. How does parental leave affect fertility and return to work? Evidence from two natural experiments. Quarterly Journal of Economics 124 (3) 1363–1402.

Matos, K., Galinsky, E., 2012. National Study of Employers. Families and Work Institute. http://familiesandwork.org/site/research/reports/NSE_2012.pdf (accessed November 2013).

Osmani, S., Sen, A., 2003. The hidden penalties of gender inequality: fetal origins of ill-health. Economics & Human Biology 1 (1) 105–121.

Roe, B., Whittington, L.A., Fein, S.B., Teisl, M.F., 1999. Is there competition between breast-feeding and maternal employment? Demography 36 (2) 157–171.

Rossin, M., 2011. The effects of maternity leave on children's birth and infant health outcomes in the United States. Journal of Health Economics 30 (2) 221–239.

Rossin-Slater, M., Ruhm, C.J., Waldfogel, J., 2013. The effects of California's paid family leave program on mothers' leave-taking and subsequent labor market outcomes. Journal of Policy Analysis and Management 32 (2) 224–245.

Ruhm, C.J., 1998. The economic consequences of parental leave mandates: lessons from Europe. Quarterly Journal of Economics 113 (1) 285–317.

Ruhm, C.J., 2000. Parental leave and child health. Journal of Health Economics 19 (6) 931–960.

Sherriff, R.L., 2007. Balancing Work and Family. California Senate Office of Research.

U.S. Bureau of Labor Statistics, 2007. National Compensation Survey: Employee Benefits in Private Industry in the United States. U.S. Department of Labor.

U.S. Commission on Family and Medical Leave, 1996. A Workable Balance: Report to Congress on Family and Medical Leave Policies. http://digitalcommons.ilr.cornell.edu/key_workplace/1/ (accessed August 2013).

U.S. Department of Health and Human Services, 2011. The Surgeon General's Call to Action to Support Breastfeeding. U.S. Department of Health and Human Services, Office of the Surgeon General, Washington, DC. http://www.surgeongeneral.gov/library/calls/breastfeeding/calltoactiontosupportbreastfeeding.pdf (accessed August 2013).

Visness, C.M., Kennedy, K.I., 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.