ESSAYS ON HEALTH AND LABOR POLICIES

by

Siying Liu

B.A., Economics, Peking University, 2010

LL.B., International Relations, Peking University, 2010

M.A., Economics, University of Pittsburgh, 2011

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This dissertation was presented

by

Siying Liu

It was defended on

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and approved by

Dr. Daniel Berkowitz, University of Pittsburgh, Economics

Dr. Daniele Coen-Pirani, University of Pittsburgh, Economics

Dr. Julia Driessen, University of Pittsburgh, Public Health Policy and Management

Dr. Werner Troesken, University of Pittsburgh, Economics

Dissertation Director: Dr. Daniel Berkowitz, University of Pittsburgh, Economics

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Siying Liu, PhD

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This dissertation consists of three papers on health economics and labor economics.

The first chapter investigates how workplace breastfeeding laws that require firms to provide a lactation room in the workplace affect the labor market outcomes of mothers of infants. Summers (1989) predicts that such mandated benefits depress the demand for mothers of infants and increase their supply and, thus, depress wages. However, I argue that such mandated benefits can increase both the demand for and the wages of mothers of infants who have a strong propensity to increase their work attachment. I exploit the plausibly exogenous variation in the timing of state mandates on workplace lactation support, analyzing data in the National Immunization Survey and the Current Population Survey.

The second chapter investigates changes in the usage or preventive services among the Medicare beneficiaries following the Affordable Care Act's "Medicare Preventive Benefits" reform, which eliminates cost-sharing for Medicare-covered preventive services that are recommended (rated A or B) by the U.S. Preventive Services Task Force. Following intuition in Chetty et al. (2013) that individuals with no knowledge of certain policies behave as they would in the absence of the policy, I identify the impact of the reform by comparing the usage of all Medicare-covered preventive services across regions with different levels of knowledge of the reform. Exploiting the sample of beneficiaries that move across HRRs, I

find that the knowledge of the reform is driven by the demand side factors rather than the supply side factors.

The third chapter investigates the causal impact of physician counseling on obesity, exploiting the eligibility criterion of the Medicare's Intensive Behavioral Therapy (IBT) for Obesity program, using a fuzzy Regression Discontinuity (RD) approach. I using the 5% random sample of the Medicare historical claim data and I inventively collect the BMI information using the ICD-9 diagnosis codes. I find that the intensive behavioral therapy is not effective in reducing obesity, and we are able to rule out confounding factors such as the use of bariatric procedures, massages, psychological therapy, smoking counseling, and the diagnoses of chronic conditions.

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PREFACE

This dissertation is original and unpublished work. I am indebted to my advisors, Daniel Berkowitz, Daniele Coen-Pirani, Julia Driessen, and Werner Troesken, for their trust and guidance. I also thank Luca Rigotti, Yang Song, Lily Yang, Yuting Zhang, and my friends and teachers at the University of Pittsburgh and Carnegie Mellon University. I thank my family for their love and support. I also wish to thank myself, for my curiosity and perseverance. I am grateful for the privilege of pursuing a PhD.

1.0 THE INCIDENCE OF WORKPLACE BREASTFEEDING BENEFITS

1.1 INTRODUCTION

The federal and state governments in the United States require employers to provide maternal benefits, including health insurance with comprehensive coverage of childbirth and maternity leaves with protected job security. Nevertheless, the labor market impact of these mandated benefits is controversial. Summers (1989) argues that these benefits depress wages because they increase the employers' hiring cost for working mothers and encourage working mothers to supply more labor. Moreover, there may be a decline in the total labor input, wherein the increase in mothers' labor supply is weaker than the fall in demand.

Evidence about the impact of such mandated benefits is mixed. Gruber (1994) finds, first, that the costs of state-mandated health insurance coverage of childbirth substantially shift to the wages of the targeted group, and, second, that there is little effect on that group's total labor input. In a study of nine European countries from 1969 to 1993, Ruhm (1998) finds that parental leave is associated with increases in women's employment and reductions in their relative wages at extended durations. Waldfogel (1999), who estimates the impact of the 1993 Family and Medical Leave Act, finds that mandated maternity leaves of up to twelve weeks have no significant negative effects on women's employment or wages. Waldfogel (1999) also finds that in large large firms wages are higher, which perhaps reflects intangible aspects of employment continuity, such as higher productivity due to the firm-specific human capital and greater job satisfaction.

This paper investigates the impact of another type of maternal benefits mandated at the workplace, breastfeeding support, and it provides a theoretical framework within which predictions are consistent with the empirical results. From 1995 to 2012, about half of the states enacted laws that require employers to provide the benefits.[1] Although the wording and detailed requirements on the breaks and space differ, most states mandate that employers must provide daily unpaid break time at the nursing employee's request and make reasonable efforts to provide a private and clean non-bathroom location.

Workplace breastfeeding support is an attractive setting in which to examine the labor market impacts of the mandated benefits because the reform lowers the workers' relative time costs of breastfeeding. This enables women with the most means and ability to work longer hours, which, in turn, increases their attachment to the workforce. The amount of breast milk output is determined by the frequency and thoroughness of milk removal; having breastfeeding breaks daily, usually 20 to 30 minutes every 3 to 4 hours, increases the duration of breastfeeding, allows young women to continue breastfeeding after they resuming working, and prevents the early weaning of the child.

Exploiting the plausibly exogenous variation in state-level mandates, I start by estimating the impact of workplace breastfeeding support. As I will argue subsequently, the temporal and spatial variation of the law is plausibly orthogonal to a multitude of state-level characteristics. I use two nationally representative data sets, the Current Population Survey and the National Immunization Survey. Breastfeeding outcomes include the initiation (if the mother ever breastfeeds) and the duration (the number of weeks) of breastfeeding. The labor market outcomes include outcomes during the reference week of the survey, such as labor force participation, hours worked last week, whether hourly wages were received,

[1] With the exception of Utah, which passed the mandate in 2012, all of the other states that have passed the mandate did so before 2010, when the Affordable Care Act mandated the workplace breastfeeding benefits at the federal level.

and the hourly wage if paid by the hour. I also examine outcomes during the previous year of the survey, such as employment last year, whether the mother worked full time last year, and last year's hourly wage.

Using a difference-in-differences framework, I find that workplace breastfeeding benefits increase the number of weeks of breastfeeding by 4.3%, although they have no impact on the initiation of breastfeeding. Using a triple difference-in-differences framework with males as the primary control group, I find that the labor force participation rate of mothers of infants increased by 1.16 percentage points. The married mothers work for 5% longer hours per day and receive a 4.6% higher wage; the single mothers do not work longer and receive a 3.8% lower wage. There appears to be little sorting of the observational characteristics, except that the married mothers in the treated states are less likely to be high school dropouts and are more likely to come from households with higher incomes; single mothers do not differ according to the treatment status. The results are robust to a series of alternative specifications: using males who have infant children and females who do not have children as alternative control groups; using the event-study frameworks for the labor market outcomes; and using the hazard models for results on the duration of breastfeeding.

The findings are consistent with a framework of Summers (1989) extended to allow two separate labor markets for workers who have high and low productivity—i.e., the ability to increase their work attachment by working longer hours. The differential changes of supply and demand in the two markets drive several differential effects of breastfeeding support on mothers who have high and low levels of work attachment. First, breastfeeding support at the workplace increases the cost of hiring for both types, and it shifts the demand curves for both types downward. Second, both types of workers value the breastfeeding benefits and increase their labor supply. Third, the provision of longer hours of work (i.e., the increase of work attachment) leads to an increase in the desirability of the relatively more productive workers, which, in turn, leads to an upward shift of the demand curve for this high type.

The upward shift of demand outweighs the downward shift of demand caused by higher costs, and so the wages and the employment of the relatively more productive mothers both increase. In contrast, the wages of less productive mothers decrease, although the change of their employment is ex ante ambiguous; the empirical results for less productive mothers seem to suggest that employment increases and that the shift of supply is larger than the shift of demand.

I assume that the workplace breastfeeding benefits affect the high- and low-type mothers differently, which is consistent with the literature on the differential compensating methods used by firms for skilled- and nonskilled-workers and for the male and female workers. For example, my assumption that workers differ in their ability to increase job attachment mirrors Lazear and Rosen (1990)'s assumption that workers differ in their willingness to leave firms. They argue that job promotion choices depend on the worker's propensity to remain on the job, which is important because any firm-specific learning is lost when a worker leaves the firm.

To estimate the incidence of the benefits in cross-section and in time series, I next estimate their spill-over effects (e.g., how workplace breastfeeding benefits affect the mothers of older children), dynamic effects (whether several years postpartum we see an effect on the labor market outcomes of mothers who had access to the benefits during the first postpartum year), and lagged effects (whether in females with infant children the passage of the workplace breastfeeding benefits created a one-time shock or a stable effects over many years). I find that the spill-over effects track the pattern of the dynamic effects, partly because of the mechanical result of the difference-in-differences specification. However, the workplace breastfeeding support demonstrates a lagged effect that is different from the dynamic and spill-over effects, and that persists for up to eight years after the enactment. These findings suggest that workplace breastfeeding support has a durable impact on the labor market outcomes of the mothers of infants.

Then, exploiting the heterogeneity in the details of the state mandates—whether state mandates allow longer years of benefits (three versus one year post-birth), allow breast-feeding in addition to pumping, prohibit discrimination, or have whistle blowers and/or retaliation protection—I estimate the heterogeneous effects of the workplace breastfeeding benefits and compare these with the benchmark effects. I find that when the workplace breastfeeding benefit is offered for more than one year or when discrimination against employees who request breaks is prohibited, the employment of the mothers of infants significantly improves. Allowing both breastfeeding and pumping does not have a significant effect but having retaliation protection does. Simply encouraging the provision of the workplace breastfeeding benefits may lead employers to hire fewer nursing mothers; but when hired, those mothers work longer hours and receive higher wages. These findings seem to imply that employers can discriminate against the less productive mothers on the extensive margins.

Finally, to investigate the channels, I examine occupational differences in temporal flexibility at the workplace, as defined in Goldin (2014), to see if the effects differ along the five dimensions of flexibility: time pressure, contact with others, establishing and maintaining interpersonal relationships, structural vs. unstructural work, and freedom to make decisions. I find that the main impact of the workplace breastfeeding benefits is robust to the additional control of the temporal flexibility at occupational level. In addition, in occupations that have less flexibility, the increase in labor force participation is smaller, the increase in hours of work is larger, and the increase in the probability of working full-time is larger. These findings are consistent with Goldin (2014) who demonstrates that firms reward individuals who are willing to work long hours and in particular hours: jobs that provide less temporal flexibility often require higher human capital and are winner-take-all positions. These are also positions for which considerable work hours lead to a higher chance of promotion and a larger reward.

This paper contributes to three threads of literature. First, the paper contributes to the literature that examines the factors that determine the initiation and duration of breastfeeding. For example, Jayachandran and Kuziemko (2011) find that the preference for sons impacts the duration of breastfeeding; Chatterji and Frick (2005) show that the timing and intensity of returning to work affects the probability of initiating and the duration of breastfeeding. To the best of my knowledge, this paper is the first to show that breastfeeding support at the workplace causally affects the duration of breastfeeding.

Second, this paper contributes to the literature that examines the factors that determine the employment and wages of women who have young children. Previous studies have found that the female labor supply increases: if women have less commuting time (Black et al., 2014); if the mother or mother-in-law lives nearby (Compton and Pollak, 2014) or works (Fernández et al., 2004); if during the WWII the state drafted more males (Acemoglu et al., 2004); where generous childcare subsidies or child care services are available (Baker et al., 2008; Lefebvre and Merrigan, 2008; Cascio, 2009; Bauernschuster and Schlotter, 2015); if women spend less household expenditures on day care (Blau and Robins, 1988; Connelly, 1992; Blau and Currie, 2006; Hardoy and Schøne, 2015); if women have generous maternity leave (Baker and Milligan, 2008); and if women can hire foreign domestic workers as affordable live-in help (Cortes and Pan, 2013). To the best of my knowledge, this paper is the first to evaluate the causal impacts of the workplace breastfeeding support on women's employment and wages.

Third, this paper contributes to the literature that devises quasi-experimental legal changes to identify the causal effects of labor market policies (Gruber, 1994; Angrist and Evans, 1998; Klerman, 1999; Levine et al., 1999; Waldfogel, 1999; Bailey, 2006; Baker and Milligan, 2008; Rossin, 2011; Blau and Kahn, 2013). For example, Bailey (2006) uses plausibly exogenous variation in state consent laws to evaluate the causal impact of the birth control pill on women's labor force participation. Similarly, Baker and Milligan (2008), who exploit a significant increase in Canadian maternity leave mandates, find very large increases in mothers' time away from work post-birth and in the attainment of critical breastfeeding duration thresholds. To the best of my knowledge, this paper is the first to evaluate the impact of state mandates on workplace breastfeeding support. My finding that workplace breastfeeding benefits increase wages, is different from the predictions made by Summers (1989) and Gruber (1994). My findings also contributes to the theoretical understanding of the impact of the mandated benefits.

The rest of the paper proceeds as follows. Section 2 reviews the relevant background information on breastfeeding and laws that affect workplace breastfeeding support. Section 3 outlines a simple theoretical framework, while Section 4 describes the data. Section 5 presents the empirical strategy and the results of breastfeeding outcomes. Section 6 presents the empirical strategy and the results for the labor market outcomes. Section 7 investigates the possible mechanisms and Section 8 presents additional results for the labor market effects. Section 9 concludes.

1.2 BACKGROUND

1.2.1 Benefits of breastfeeding

Breastfeeding has been widely examined in both the medical and the economic literatures. In the medical literature there is broad consensus about the health benefits of breastfeeding for both the mother and the baby. For mothers, breastfeeding has been linked to a decrease in postpartum bleeding, an earlier return to pre-pregnancy weight, and a reduced risk of breast cancer, type 2 diabetes, and postpartum depression. The potential health benefits for breast milk-fed children are extensive: reduced risk of ear, skin, stomach, and respiratory infections; fewer cases of diarrhea; and less sudden infant death syndrome. Over the longer term, breast milk-fed children have a reduced risk of obesity, type 1 and type 2 diabetes, asthma, and childhood leukemia (United States Breastfeeding Committee, 2010; Rothstein, 2013).

The results of economics examinations of the causal impacts of breastfeeding on health and cognitive outcomes have been mixed. For example, Baker and Milligan (2008) found that additional breastfeeding had no impact on maternal and child health outcomes, while Belfield and Kelly (2012) found that breastfeeding protects against obesity and improves cognitive outcomes at 24 months and 54 months. Rothstein (2013) found a small, positive, and statistically significant effect of breastfeeding on the cognitive test scores of young children, but within-sibling results are insignificant.

1.2.2 Historical trend of breastfeeding

During the 1800s, more than 95% of infants in the U.S. were breastfed, often for two to four years (Andrews, 2012). An alternative is cow's milk, which, if tainted, can lead to diarrhea and other illnesses. With the pasteurization of milk and the sterilization of feeding vessels, artificial milk became a safe and marketable option. During the 1920s, scientists also began developing non-milk-based formulas for infants allergic to cow's milk. The first soy flour-based non-milk formula became available to the public in 1929 (Fomon, 2001). As formulas evolved, manufacturers advertised directly to physicians. In 1929, the American Medical Association formed the Committee on Foods, which approved the safety and quality of the non-milk formula composition (Stevens et al., 2009). During the 1940s, formula-feeding was the norm in the United States, and fewer than 30% of American babies were fed from the breast (Andrews, 2012).

By the 1950s, physicians and consumers had come to regard formula as a well-known, popular, and safe substitute for breastmilk, and breastfeeding steadily declined until the 1970s (Fomon, 2001). Figure A1 and Figure A2 are taken from Ryan et al. (2002), who obtained the data from the Ross Laboratories Mothers' Survey. They show trends in breastfeeding initiation and duration from the 1960s through the early 2000s. Although the popularity of breastfeeding decreased during the 1980s, since 1990 there has been a resurgence of breastfeeding. Figure A3 and Figure A4, which are based on data from the National Immunization Survey, show that the initiation and duration of breastfeeding has continued to grow into the 2000s. The American Academy of Pediatrics (United States Breastfeeding Committee, 2010) currently recommends exclusive breastfeeding (only breast milk, without water, formula or solid food) for the first six months of a child's life and then continued breastfeeding through at least the first year. In 2014, the percentage of mothers who have breastfed is 79.2%. The percentage of mothers who are still breastfeeding at various intervals after birth decreases quickly: 49.4% in the sixth month but only 26.7% in the twelfth month (Centers for Disease Control and Prevention, 2014).

1.2.3 Federal laws regarding workplace breastfeeding support

In 1981, the U.S. Court of appeals, Fifth Circuit, ruled that breastfeeding is a constitutional right that is linked to the protected liberties of "individual decisions respecting marriage, procreation, contraception, abortion, and family relationships." The court held that a public employer's interference with a woman's decision to breastfeed must "further sufficiently important sate interests and be closely tailored to effectuate only those interests." However, the US supreme court has not yet examined the ruling, which is considered an anomaly (Murtagh and Moulton, 2011).

Discrimination against breastfeeding is not equivalent to discrimination based on gender, pregnancy, or disability. Breastfeeding is not protected by Title VII of the Civil Rights Act of 1964, which prohibits discrimination on the basis of gender; nor is it protected by the Pregnancy Discrimination Act of 1978, which amended Title VII to protect against discrimination "because of or on the basis of pregnancy, childbirth, or related medical conditions." Breastfeeding is a normal condition associated with pregnancy, and the courts have consistently ruled that it is not a disability or protected by the Americans With Disabilities Act (Murtagh and Moulton, 2011).

By allowing eligible employees to take a total of 12 weeks of unpaid maternity leave, the Family Medical Leave Act of 1993 indirectly promotes breastfeeding. To qualify, eligible employees must have worked for at least the 12 previous months and for a minimum of 1250 hours, must reside within 75 miles of the place of work, and must work for businesses that employ at least 50 people.

The first federal law to directly support breastfeeding at the workplace was the Patient Protection and Affordable Care Act of 2010. Section 4207 of the Affordable Care Act, which amends the Fair Labor Standards Act of 1938, requires employers to provide reasonable break time and a private location other than a bathroom to express milk for a child aged up to 1 year. The breaks are unpaid. Eligible employees are those covered by the Fair Labor Standards Act's overtime provisions. Prior to the Affordable Care Act of 2010, legal support of breastfeeding was provided at the state-level only.

1.2.4 State laws that provide workplace breastfeeding support

Table A1 lists the years that various states passed the "Workplace law." It summarizes state laws that require employers to provide unpaid break time and a special space for expressing breast milk. States that have passed state laws that support breastfeeding at workplace, such as Hawaii, also are included. I summarized the data using the website of National Conference of State Legislatures[2], and tables in Andrews (2012) and Abdulloeva and Eyler (2013). Texas was the first state to pass a version of the workplace breastfeeding support law.

The details of workplace law differ from state to state. Some states specify the frequency of the breaks; Oregon, for example, requires "unpaid 30-minute breaks during each four-hour shift to breastfeed or pump." Others, such as Georgia, simply require "daily, unpaid break time." Requirements about the duration of the benefits also differ. Colorado allows

[2]http://www.ncsl.org/research/health/breastfeeding-state-laws.aspx, accessed April 2015.

for up to two years after the child's birth, while Maine allows up to 3 years. Some states do not specify the number of years that are protected. Details about the space also vary. Illinois requires "a room or other location, other than a toilet stall, where an employee can express her milk in privacy," while Indiana goes so far as to require that the employer "make reasonable efforts to provide for a refrigerator to keep breast milk that has been expressed."

Some state mandates specify that discrimination is prohibited. For example, Maine stipulates that "the employer may not discriminate against an employee who chooses to express breast milk in the workplace." Other states allow for exemptions. Georgia, for example, stipulates that "the employer is not required to provide break time if to do so would unduly disrupt the workplace operations."[3]

As for enforcement, some states establish a specific committee that collects information about possible violations. For example, Rev. Stat. 367-3 requires the Hawaii Civil Rights Commission to collect, assemble and publish data concerning instances of discrimination involving breastfeeding or expressing breast milk in the workplace. Other states specify penalties against violations. California requires that "(a) An employer who violates any provision of this chapter shall be subject to a civil penalty in the amount of one hundred dollars ($100) for each violation; (b) if, upon inspection or investigation, the Labor Commissioner determines that a violation of this chapter has occurred, the Labor Commissioner may issue a citation." Oregon specifies that "In addition to any other penalty provided by law, the commissioner may assess a civil penalty not to exceed $1,000 against any person who intentionally violates ORS 653.077 or any rule adopted thereunder."

[3]In one case study, Henry et al. (2011) found that employers' evaluation of feasibility was related to the size of the business. According to anecdotal evidence that they provide, some employers found it hard to define privacy in determining an appropriate space, and some employers reported that providing the breaks disrupted the productivity and elicited protest from coworkers.

1.2.5 Breastfeeding breaks at the workplace

Attitudes in the workplace about breastfeeding affect whether mothers initiate and continue breastfeeding for the recommended duration. Educational interventions as well as counseling, support and training can improve the initiation rates during the hospital stay and for the next few weeks. Mothers who do not breastfeed may not know the benefits of breastfeeding, and those who stop early report difficulty with technique or express concerns that their child is not getting enough food (Baker and Milligan, 2008). Most often, the principal impediment to prolonging breastfeeding duration past the initial weeks is work. Surveyed mothers say the need to return to work is one of the main reasons that they stop breastfeeding at about six weeks and it is the principal reason that many do not breastfeed for longer durations (Schwartz et al., 2002; Fein and Roe, 1998).

Breastfeeding breaks during workdays facilitate continuing breastfeeding. The breast milk output is determined by the frequency and thoroughness of milk removal. An exclusively breastfed baby (under six months) feeds between 8 and 14 times per 24 hours. If mother and child are separated for more than a few hours, the woman herself must express milk, both to maintain production and to ensure her own health and comfort. Milk left in the breast beyond 3 to 4 hours signals the body to slow its rate of production and decrease the woman's total daily output, which leads mothers to stop breastfeeding and use formula (United States Breastfeeding Committee, 2010). Using the 2008 Infant Feeding Practice Survey, Fein et al. (2008) found that during the first month after returning to work, 31.8% of the workers keep the infant at work and breastfeed during the work day; 7.9% go to the infant to breastfeed during the work day; 2.9% have the infant brought to them to breastfeed during the work day; 52.7% pump milk and save it for the infant; 0.6% pump and discard the milk; and only 15.9% neither pump nor feed the infant during the work day because they have stopped breastfeeding. As the proportion of women participating in the labor force after giving birth has grown, workplace attitudes about breastfeeding have increasingly affected mother's decisions about breastfeeding and whether or when to return to work postpartum. In 2010, 58.8% of women with infant children were in labor force; in 1990 that percentage was only 48.9% (the Current Population Survey).

Providing breastfeeding support at the workplace incurs a cost to the employer. According to estimates provided by the Minnesota Department of Health and the Texas Department of Health, the costs of providing a special space and basic amenities, such as a table, chair, sink, and storage, range from $145 for minimum accommodation to $525 for maximum accommodation. The costs will be higher if the employer provides additional benefits, such as coverage of the cost of pumps. An employee could use her own manual/electric pump, or she could purchase and use an individual kit when her employer rents a hospital-grade, heavy-duty multi-user pump.

1.2.6 The validity and relevance of the law as a natural experiment

For two reasons, the law regarding workplace breastfeeding support provides an ideal setting to study the causal impact of work on breastfeeding. First, since the 1993 change of the Fair Labor Standards Act (FLSA), the U.S. has not experienced any change in policies that might affect breastfeeding decisions. In particular, state laws that regulate workplace breastfeeding support, which were passed during the late 1990s and 2000s, provide an opportunity to examine changes in recent breastfeeding patterns.[4] Second, only 24 states and the District of Columbia passed a version of the law, and they passed it in different years; this difference in timing creates variation in the degree of exposure to workplace breastfeeding benefits, which, in turn, provides an opportunity to identify causal effects.

Figure A5 displays geographical variation in the timing of the workplace breastfeeding law. There is no clear spatial pattern to the passage and timing of the law. The figure

[4] The first state law that mandated workplace breastfeeding support passed in 1995. Thus, the 1993 change in the FLSA affected all states, and its effects can be absorbed by the common year fixed effects, which poses no threat to identifying the effects of the state laws.

provides visual evidence that the passage of the law was spatially random.

One concern is that the passage of state laws might be correlated with prior levels of breastfeeding; that is, states that already have high or low rates of breastfeeding might pass the law to encourage or further increase the rate of breastfeeding. My inspection of the institutional background indicates that both possibilities are plausible. For example, Florida passed its law as "an endorsement of the importance of Florida infants being breastfed and protect a mother's right to breastfeed whenever and wherever she needs to," and because "Florida has one of the lowest breastfeeding rates in the nation...This bill would...make women more secure in their right to breastfeed."[5] In contrast, Minnesota, which passed a version of the law in 1999, has one of the highest breastfeeding rates in the country.

State level mandates can be used as a quasi-experiment to identify the causal impact of workplace breastfeeding benefits on women's feeding and labor market outcomes only if the mandates do not reflect pre-existing differences in state-level characteristics. Next I provide empirical evidence that initial state-level characteristics cannot predict the passage and the time lag of the regulation.

I examine state-level characteristics computed for all 50 states and the District of Columbia using the 1990 IPUMS Census 1% sample. The variables include characteristics of the total population of the state and women of child-bearing age. I also use the ideology measures for individual states published in Berry et al. (1998). For example, characteristics of the total population include the percentage of state population that: lives in the central metropolitan area, is white, is in the labor force, and is employed. Also important is average wage income; average welfare income from the government; average transfer income received for the child; average firm size; and the percentage of women who are aged between 15-21, 22-30, and 31-44, are of child-bearing age (aged 15-44), are college graduates, are single, are in the labor force, are employed, or have child/children. Ideology scores include

[5] http://www.flbreastfeeding.org/legislation.htm, accessed April 2015.

those of the Republican Party, the Democratic Party, the governor of the state, the state as a whole, and citizens. These variables are proxies for the degree of conservativeness of the various states (Berry et al., 1998).

Table A2 shows that no systematic differences distinguish states that did or did not pass the law. The dependent variable is a dummy variable that equals one if the state passed the law by 2010 and 0 otherwise. Each cell shows the point estimate and standard error of the state-level characteristics of interest from a regression of the dependent variable on these characteristics. The regressions are weighted by each state's population. Only 2 of the 21 parameters are statistically significant, which suggests that passage of the law is plausibly exogenous. The significant parameters suggest that certain scenarios are particularly possible. For example, people who live in central metropolitan areas are especially likely to work for large firms for whom workplace benefits are critical. In these areas, workers are especially likely to push for passage of the workplace law. Similarly, if a large percentage of the residents of a state are women aged 31-44, politicians might be likely to appeal to these residents by passing the law. These characteristics cannot jointly predict the passage of the law; the F-statistics is 1.51.

Table A3 demonstrates that the state level characteristics cannot predict whether some states passed the law earlier than others. The dependent variable is the actual year a state passed the law, minus 1995, which is the first year the law was passed—in other words, the time lag of the passage of the law. Almost all of the parameters, except for one—the average welfare income—are statistically insignificant, which indicates that the timing of the passage of the law is independent from state-level characteristics. If regressing the time lag on all characteristics, the joint F-statistics is 1.38, which, too, is insignificant.

Table A2 and Table A3 offer evidence that the issue of selection into passing the law is not significant among the observed state level characteristics that one could test using the above method. Like Altonji et al. (2005), I assume that if the degree of selection on the observed characteristics provides insight about the degree of selection on the unobserved characteristics, it is reasonable to conclude that the state mandates on the workplace breastfeeding benefits seem to be a valid quasi-experiment. To further control for the unobserved state-level characteristics, I include in the empirical analysis state fixed-effects to control for the unobserved state level characteristics that do not vary by year, state-specific linear/quadratic time trends to control for the unobserved state level characteristics that vary within each state by year linearly/quadratically, and in the robustness tests the census-region-by-year fixed-effects to control for the unobserved region-specific characteristics that vary by year.

Because of the limitations of the data, one cannot directly observe whether employers actually provide the mandated benefits. According to the Employer Benefits Survey, the percentage of employers that provide workplace breastfeeding benefits has gradually risen. For example, the percentage of employers that provide workplace breastfeeding rooms increased from 25% in 2009 to 34% in 2013. Thus, it is plausible to interpret the empirical results as an "intention to treat" effect rather than a "treatment on the treated" effect (Angrist and Pischke, 2008).

1.3 THEORETICAL FRAMEWORK

In this section, I discuss, first, the standard framework on the mandated benefits and, second, how the model should be modified when we consider workplace breastfeeding benefits and derive its implications.

Summers (1989) offers the standard framework for comparing the welfare implications of public provision and mandated benefit programs. Figure A6 illustrates how mandated benefits affect the wages of those who receive the benefits. Because it is costly to provide these benefits, the demand curve shifts downward, by an amount equal to the monetary costs of the benefits. If workers value the benefits, their supply curve should shift downward;

the magnitude of the shift depends on how much workers value the benefits. Depending on the relative magnitudes of the shifts in the supply and the demand curve, the new equilibrium will always have a lower wage, although the change in employment can occur in both directions.

Figure A7 illustrates my proposed model. Two types of workers—those with high and those with low productivity—differ in their ability of increasing their work attachment by working longer hours. Barriers separate the two markets, which I refer to as high-type and low-type markets. Differential changes in supply and demand in the two markets drive the differential effects of breastfeeding support on mothers who have high or low levels of productivity.

First, breastfeeding support at the workplace increases the cost of hiring both types because, as Oi (1962) proposes, the cost of employment includes both the wage and the cost of hiring and training. The latter is, in effect, an investment by the firm in its labor force, and it creates an element of capital in the use of labor.[6] The additional costs of hiring shift the demand curves for both types downward.

Second, both types of workers value the breastfeeding benefits and increase their labor supply. It is reasonable to assume that the high-type workers increase their supply by a larger amount than the low-type because it is easier for them to increase the work attachment and increase the hours of work, although the relative magnitudes do not affect the framework's predictions.

Finally, the provision of longer hours of work—that is, an increase in the work attachment—leads to an increase of the desirability of the relatively more productive workers, which, in turn, leads to an upward shift in the demand curve for the high type only. Because this

[6]The assumption that labor is a quasi-fixed factor is essential in explaining short-run labor market behaviors such as occupational differences in the stability of employment and wages. Oi (1962) argues that because the firm incurs certain fixed employment costs, such as hiring and training costs, the amortization of these fixed employment costs drives a wedge between the marginal value product and the wage rate. This creates buffer absorbing short-run variations in product demands, which leads to occupational differences in the stability of employment and wages.

upward shift of demand outweighs the downward shift of demand the wages and employment of the relatively more productive mothers both increase. In contrast, the wages of the less productive mothers decrease, although the change in their employment is ex ante ambiguous.

My assumption, that the heterogeneous effects of workplace breastfeeding benefits affect the high- and low-type mothers differently, is consistent with the literature on the differential compensating methods that firms use for skilled- and nonskilled-workers and for male and female workers. For example, Lazear and Rosen (1990) assume that more productive jobs coexist with less productive jobs and that job promotion choices depend both on the worker's ability and her propensity to remain on the job, which is important because any firm-specific learning is lost when a worker leaves the firm. My assumption that workers differ in their ability to increase job attachment mirrors Lazear and Rosen's assumption that workers differ in their propensity to leave firms (females are more likely than males to leave, and thus they receive a lower wage).

Similarly, Goldin (2014) argues that any explanation of the residual of gender-wage gap should rely on a labor market equilibrium that has compensating differentials and, in particular, examines how firms reward individuals who can work long hours and particular hours. My assumption that productivity is the ability to increase the work attachment is consistent with Goldin's (2014) key idea that persistence and continuous time on the job matter for the residual of the gender-wage gap.

In summary, following Summers (1989), I extend the standard framework on mandated benefits by assuming that there are two types of workers who differ in their levels of productivity, which we can also describe as the ability to increase the work attachment. I derive the following implications for mandated breastfeeding benefits: for the more productive mothers, their wages and employment both increase; for the less productive mothers, their wages decrease, although the change on employment is ex ante unclear. In the next few sections I test these hypotheses empirically.

1.4 DATA

I examine data from two nationally representative surveys. First, to estimate the effects on the labor market outcomes, I use the March Current Population Surveys (CPS), 1990-2010, which I downloaded from the IPUMS. I do not include years later than 2010 because on March 23, 2010, the Affordable Care Act amended the Fair Labor Standards Act and made the provision of reasonable break time and space for an employee to express breast milk a federal mandate. To the extent that women's labor market outcomes depend on their marital status or, in the case of married individuals, their partner's characteristics, I merge partner's characteristics using the spouse location variable. The spouse characteristics include age, levels of education, race, and labor force participation status.[7] The main sample of interest consists of people aged 18-44. Because our identification comes from state level mandates, and to reduce confounding factors that are linked to migration, I drop individuals whose migration status one year ago was moving between states, moving from abroad, or unknown. My sample includes individuals who during the previous year of the survey have continued to reside in the same house, have moved only within their county, or have moved between counties but have remained in the same states.

Second, to estimate the effects on the breastfeeding outcomes, I use the National Immunization Survey (NIS) waves of 2003-2013; the sample consists of babies born between 2001 and 2010.[8] The NIS is conducted jointly by the National Center for Immunizations and Respiratory Diseases, the National Center for Health Statistics, and the Centers for Disease Control and Prevention. It is the only source of nationally representative repeated cross-sectional data about the initiation and duration of breastfeeding. The NIS has collected

[7]The CPS's spouse location variable also defines non-married partners as spouses. Therefore, one can have a spouse without being married.

[8]The NIS data do not report the baby's year of birth, but they do report the babies' age as a categorical variable: 19-23 months, 24-29 months, and 30-35 months. I estimate the year of birth on the basis of the year of the survey and the age categories. First, I subtract from the survey year of the babies in these three age categories by 1.75 (=(19+23)/24), 2.21 (=(24+29)/24), and 2.71 (=(30+35)/24), respectively. Then, to find the actual years of birth I round the numbers up or down.

information on breastfeeding behavior since 2003. The feeding outcome variables of interest are determined by the answers to the following two questions: 1. Was [FILL CHILD'S NAME] ever breastfed or fed breast milk? 2. How old was [FILL CHILD'S NAME] when [FILL CHILD'S NAME] completely stopped breastfeeding or being fed breast milk? These answers are generated from recalled memory. Because the measurement error of the dependent variable can be absorbed by the disturbance of the regression and ignored as long as the regressors are measured properly (Greene, 2008, p.326), one need not be concerned about the measurement error of these recalled variables.

1.5 EMPIRICAL RESULTS ON BREASTFEEDING

1.5.1 Econometric frameworks

Because the unit of observation in the NIS for breastfeeding outcomes is each baby, the main framework is a difference-in-differences, or a DD specification:

$$y_{ist} = \alpha + \beta Workplace_{st} + X_{ist}^{'}\Gamma + \theta_s + \theta_t + \theta_s \cdot t + \epsilon_{ist}, \tag{1.1}$$

where the outcome variable is one of the following variables: $EverBf_{ist}$, a dummy variable that equals one if the baby is ever breastfed, or 0 otherwise; $log(WeeksBf_{ist})$, the log of the number of weeks of breastfeeding, where the number of weeks is censored at 104 weeks.

The variable $Workplace_{st}$ is a dummy variable that equals one if the state s passed a version of the workplace breastfeeding support mandates during year t; otherwise it is 0. The parameter β, which is the parameter of interest, can be interpreted as the causal impact of providing workplace breastfeeding benefits on the outcome variables, under the identifying assumption that access to the law is orthogonal to the unobserved characteristics that also affect the baby's feeding pattern at the individual level. Therefore, one needs to control for the observed baby and mother characteristics, state (θ_s) and year fixed-effects (θ_t), and state-specific time trends ($\theta_s \cdot t$). X_{ist}, which is the vector of covariates, includes the following characteristics: baby's gender; race categories (Hispanic, black, and other; white is the omitted category); a dummy variable that equals one if the child ever receives benefits from the WIC (the Women, Infant, and Child program); a dummy variable that equals one if the baby is a first-born; age categories of the mother (less than 19 years old, greater than 30 years old, and the omitted category is aged between 19-30); level of the mother's education (high school dropout, high school graduate, and some college, with college graduates the omitted category); a dummy variable that equals one if the mother is married; the number of children in the household; and the ratio of household income to the poverty line. ϵ_{ist} is a random error term. I use the OLS model for the impact on $EverBf_{ist}$ and a Tobit model for the impact on $log(WksBf_{ist})$.[9]

To test for the existence of anticipation effects (whether the effects started before the actual enactment of the law) I include $PreLaw_{st}$, which is a dummy variable that equals 1 if the state s during year $t+1$ has the law (otherwise it is 0). The goal is to determine whether the outcome variables change significantly just before the enactment of the workplace breastfeeding law.

In some specifications, I also include three dummy variables that indicate the passage of three other state-level mandates related to breastfeeding ($AnyPlace_{st}$, $Jury_{st}$ and $Indecency_{st}$). These variables control for the culture of and attitude about breastfeeding at the state level. The variable $AnyPlace_{st}$ equals one if state s during year t passed a version of the mandate that allowed nursing mothers to breastfeed in any public and private space. The variable $Jury_{st}$ equals one if state s during year t passed a version of the mandate that exempted nursing mothers from jury duty. $Indecency_{st}$ equals one if state s during year t passed a version of the mandate that exempted breastfeeding in the public

[9]The estimates of the marginal effects on $EverBf_{ist}$ when a probit model is used resemble those obtained when the OLS is used. Thus, to ease interpretation, I use the OLS model. The results using the probit model are available upon request.

from being classified as public indecency. Table A20 in the appendix summarizes these three other state level breastfeeding-related mandates.[10]

Table A4 provides the summary statistics for the NIS data. The first two columns present summary statistics for the babies born in states that never passed the workplace breastfeeding law. Columns 3 and 4 present summary statistics for babies born in states that have passed the law, but during the period before the law was passed. Columns 5 and 6 present summary statistics for babies born in states that have passed the law, but during the period after the law was passed.

1.5.2 Main results on breastfeeding

Table A5 panel A shows the OLS estimates for equation (1.1) regarding the initiation of breastfeeding. Column 1, the base line result, is positive but statistically insignificant. In column 2, there seems to be no anticipation effect: the estimate for the one-year-before-law dummy, or $PreLaw_{st}$, is almost zero and it is statistically insignificant. In column 3, the estimate for the workplace breastfeeding support law (which is of a similar magnitude) remains statistically insignificant; the jury exemption law seems to increase the probability of breastfeeding. Column 4 controls for region-by-year fixed effects and column 5 does not weigh the observations using the replication weight; in each case the estimates remain insignificant. In summary, the workplace breastfeeding support law does not seem to promote the initiation of breastfeeding.

Table A5 panel B shows the Tobit estimates for equation (1.1) on the log weeks of breastfeeding. The estimate for Column 1, 0.0434, is statistically significant at the 5% level, which suggests that the workplace breastfeeding support increases the latent (uncensored) duration of breastfeeding by about 4.34%. Given that the average duration of the observed (censored) duration of breastfeeding is about 20.3 (exp(3.01)) weeks, the impact is about 6

[10] The information is summarized according to the website of National Conference of State Legislatures, Andrews (2012), and Abdulloeva and Eyler (2013).

days (0.88 weeks, or 20.3×4.34 weeks). The estimate in column 2 is smaller but it remains statistically significant at the 10% level. The estimate for the one-year-before-law dummy is very small and statistically insignificant, which suggests that there is no anticipation effect. The estimate in column 3 is statistically significant, while the estimates for the other three types of state laws are statistically insignificant, suggesting that the causal impact of the workplace breastfeeding support law is robust after controlling for cultural shifts towards breastfeeding. Column 4 controls for the region-by-year fixed effects and column 5 does not weigh the observations using the replication weights; the estimates remain similar and statistically significant. In summary, the workplace breastfeeding support law increases the duration of breastfeeding by about 4.3%.

1.5.3 Alternative explanations for breastfeeding outcomes

As an alternative to the Tobit model, we can estimate the impact of workplace laws on the duration of breastfeeding using hazard model specifications. This approach allows me to determine whether access to workplace breastfeeding support impacts the likelihood of stopping breastfeeding.

Figure A8 plots the nonparametric Kaplan-Meier survival estimates for babies born during state-years who did and did not have access to workplace breastfeeding benefits. The x-axis, which is the number of weeks of breastfeeding, ranges from 0 to 104 weeks (the duration is censored at two years). The y-axis is the percentage of babies that, among all babies are ever breastfed, still are breastfed each sequential week after birth. Figure A8 shows that babies born in states that offer the workplace breastfeeding benefits are more likely to be breastfed each week after birth. The difference is statistically significant at the 5% level.

Table A6 shows the results of the duration of breastfeeding using the hazard model specifications. The first column employs the exponential proportional hazard model of the following specification:

$$\lambda_t = \alpha \exp[\gamma_t + \beta_1 Workplace_{st} + \beta_2 Mother_{ist} \\ + \beta_3 Workplace_{st} \times Mother_{ist} + X_{ist}^{'} \Gamma + \theta_s + \theta_t + \theta_s \cdot t + \epsilon_{ist}]. \tag{1.2}$$

Columns 1 to 3 of Table A6 show the estimate of $\exp(\beta_3)$, assuming that ϵ_{ist} has exponential, Weibull or Gompertz distributions. Column 4 shows the result using the Cox proportional hazard model. The estimate in column 1, -0.036, is statistically significant at the 10% level, which suggests that access to workplace breastfeeding benefits reduces the probability of stopping breastfeeding by 3.6 percentage points. The estimates in columns 2 to 4 are of a larger magnitude and are statistically significant at the 5% level, implying that access to workplace breastfeeding benefits consistently reduces the probability of stopping breastfeeding by about 4 percentage points.

1.5.4 Subsample estimates for breastfeeding outcomes

Table A7 and Table A8 show, respectively, the subsample results of the effects of the workplace breastfeeding benefits on the initiation and duration of breastfeeding. The characteristics of interest include: levels of education (high school dropouts, high school graduates, some college, and college plus), age (younger than 19, 19-30, and older than 30 years old), marital status, race (White, Black, Hispanic, and other), and household income level (due to top coding I report the estimate for each of the first 5 deciles and I group the top 5 deciles together as the top 50%).

Table A7 shows that only among single mothers and mothers aged 19-30 do we see a statistically significant increase in the initiation of breastfeeding. This result suggests that these two groups probably lack the knowledge and support that would allow them to start breastfeeding the most, as the initiation of breastfeeding happens at the hospital and within the first few hours of giving birth. For the other groups, workplace breastfeeding benefits have no impact on their initiation decisions.

Table A8 shows that workplace breastfeeding benefits increase the duration of breastfeeding among mothers who are high school dropouts yet it decrease the duration among mothers who have some college education. Among mothers aged 19-30, mothers who are Hispanic, and mothers who belong to the top half of the household income distribution, the duration of breastfeeding increases significantly. Workplace breastfeeding benefits may reduce the racial inequality among nursing mothers yet increase financial inequality. In addition, married mothers enjoy a statistically significant increase in duration, but the increase among single mothers is not statistically significant; this difference between women of different marital statuses also appears in the effects on labor market outcomes.

1.6 EMPIRICAL RESULTS OF LABOR MARKET OUTCOMES

1.6.1 Econometric frameworks

To estimate the effects on labor market outcomes, I use a differences-in-differences-in-differences, or a DDD specification of the form

$$\begin{aligned} y_{ist} &= \alpha + \beta_1 Workplace_{st} + \beta_2 \text{Mother of infants}_{ist} \\ &\quad + \beta_3 Workplace_{st} \times \text{Mother of infants}_{ist} + X_{ist}^{'}\Gamma + \theta_s + \theta_t + \epsilon_{ist}. \end{aligned} \tag{1.3}$$

The variable $Workplace_{st}$ is a dummy variable that equals one if the state s during year t passed a version of the workplace breastfeeding support law; otherwise it is 0. The variable Mother of infants_{ist} is a dummy variable that equals one if the individual is a mother of an infant child or if her youngest child is less than one year old. I consider several ways of defining the control group. My preferred control group is the sample of males, because they are not eligible for the benefits.

The outcome variable y_{ist} is one of the following variables. lfp_{ist} is a dummy variable that equals one if individual i living in state s during year t is in the labor force; otherwise it is 0. emp_{ist} is a dummy variable that equals one if, conditional on in the labor force, the individual is currently employed; otherwise it is 0. $AtWork_{ist}$ is a dummy variable that equals one if, conditional on being employed, the individual is working during the reference week of the survey; otherwise it is 0. $log(HoursWork_{ist})$ is the log weekly working hours if the individual worked during the reference week. $PartTime_{ist}$ is a dummy variable that equals one if the individual worked less than 35 hours during the reference week, conditional on working during the reference week; otherwise it is 0. $HourlyPaid_{ist}$ is a dummy variable that equals one if the individual was paid by the hour during the reference week, conditional on working during the reference week. $log(HourlyWageLastWeek_{ist})$ is the log real hourly wage if the individual was paid by the hour during the reference week, conditional on working during the reference week.[11]

The parameter of interest is the parameter before the interaction term, β_3. My identifying assumption is that following the establishment of the workplace breastfeeding support mandates, there should be no systematical differences in outcome variables in the treated and the control group. Thus, β_3 can be interpreted as the causal effects of workplace breastfeeding benefits on the outcome variables. Because states passed different versions of the mandate over a period of years, it is difficult to identify alternative explanations that could invalidate this assumption. Nonetheless, it is meaningful to use alternative control groups and perform placebo tests. The control group should *not* be affected by workplace breastfeeding support mandates; thus, males are the best control group. I devise two alternative control groups: males who have infant children and females who do not have children.

[11]Note that all the variables are defined conditionally in order to give them a more accurate meaning. The results—for example, lfp_{ist} and emp_{ist}—can be multiplied to derive the unconditional result (the employment-to-population in this case). The selection issue is resolved by the balance checks that are reported in the next section.

X_{ist} is a vector of individual characteristics, which includes age, age squared, a dummy variable that indicates non-white status, marital status, female, an interaction term between female and marital status, levels of education (high school graduates, some college, and college graduates, with the high school dropouts as the omitted category), and dummies for industry (the omitted category is the no-industry-information dummy). θ_s and θ_t are state and year fixed-effects, respectively. ϵ_{ist} is a random error term.

Because the marginal effects of interaction terms in non-linear models are difficult to interpret, I use OLS models for the DDD specification. The regressions are weighted by the personal supplemental weights of the CPS. The robust standard errors are clustered at the state level.

So far, the outcome variables, which measure the "flow" of the labor market changes, are all measured during the reference week of the survey. Alternatively, the CPS includes variables that describe the individuals' labor market outcomes during the previous year of the survey, and they measure the "stock" of the labor market changes. Therefore, I also estimate the following equation:

$$\begin{aligned} y_{ist} = \alpha + \beta_1 Workplace_{s,t-1} + \beta_2 \text{Mother of 1-year-old}_{ist} \\ + \beta_3 Workplace_{s,t-1} \times \text{Mother of 1-year-old}_{ist} + X_{ist}^{'}\Gamma + \theta_s + \theta_t + \epsilon_{ist}. \qquad (1.4) \end{aligned}$$

where the variable Mother of 1-year-old$_{ist}$ is a dummy variable that equals one if the individual is a mother whose youngest child is 1 year old. The variable $Workplace_{s,t-1}$ equals 1 if state s during the previous year $(t-1)$ had already passed the workplace breastfeeding mandate. The outcome variables under this framework are: $EmpLastYear_{ist}$, a dummy variable that equals one if the individual was employed last year (not conditional on being in the labor force last year, based on how the variable is defined in the CPS); $FullTimeLastYear_{ist}$ is a dummy variable that equals one if the individual is employed full time, conditional on being employed last year; and $HourlyWageLastYear_{ist}$, a log of real hourly wage (it includes both the salary and wage earners' hourly wages). The intuition is that for mothers of 1-year-olds, the variables that describe labor market outcomes during the previous year of the survey measure the labor market outcomes when they were within one year postpartum. These outcomes are likely to be affected by the workplace breastfeeding benefits, if the state passed the mandate one year ago.

1.6.2 Summary Statistics of the CPS data

Table A9 provides the Summary statistics for the covariate variables in the CPS sample for samples of males and females who have infant children, both before and after the enactment of the workplace breastfeeding support law. The upper panel presents individual level characteristics, while the lower panel presents spouse characteristics for married individuals only (excluding cohabiting couples). For both the treatment and control groups, access to workplace breastfeeding benefits is associated with more people who are non-white and have college or more advanced degrees. There are no significant differences along the lines of age, marital status and household incomes.

Table A10 presents the Summary statistics of the outcomes of the treated and the primary control samples, both before and after the enactment of the workplace breastfeeding support law. The upper panel presents the outcome variables collected during the reference week of the survey; these describe the contemporaneous, or flow, outcomes of interest. Thus, the treated sample consists of females who have infant children. The lower panel presents the outcome variables that describe the labor market outcomes during the previous year of the survey; these describe stock outcomes of interest. In other words, the treated sample consists of the females whose youngest child is 1-year old. For both panels, the control group consists of all males.

Because access to workplace breastfeeding benefits started in different states during different years, the effects of the workplace breastfeeding benefits on labor outcomes are hard to interpret from simple comparisons of sample means. Therefore, we need to investigate this impact using the DDD frameworks.

1.6.3 Main results on labor market effects

Table A11 presents the basic estimates from equation (1.3), which includes a full set of state and year dummies for outcome variables during the survey's reference week, when the mothers of infant children were the main treated group. The primary control group consists of all males, while the alternative control group consists of males who have infant children. Of concern is the possibility that having an infant child could affect the new fathers' labor market outcomes; by identifying males who have infant children as the control group, one can control for the common shocks that affect the parents of infants. Columns 1-4 and 5-8 show the results using the primary and alternative control group, respectively. The first column shows the estimate of equation (1.3), while the second column shows the estimate for the sample of singles. The next two columns show the estimates of equation (1.3) for the married sample, with (column 4) and without (column 3) the spouse characteristics as additional controls. The spouse characteristics include the spouse's age, race, level of education, and labor force participation status.

Panel A shows that workplace breastfeeding benefits increased the labor force participation of females who have infant children by 1.16 percentage points, and it is statistically significant at the 1% level. This suggests that workplace breastfeeding benefits have a significant and positive impact on the extensive margin. The effects are significant for both singles and whose who are married; adding spouse characteristics, the estimate is still positive and statistically significant at the 1% level. The estimate is larger (1.42 percentage points) when males who have infant children are the control group.

Panel B shows that workplace breastfeeding benefits do not affect, and perhaps decrease, the probability of being employed, conditional on being in the labor force. The results are highly similar across all columns. The combined results of Panel A and B suggest that workplace breastfeeding benefits increase the employment-to-population ratio of females who have infant children.

Panel C shows that, among the married, and conditional on having a job, workplace breastfeeding benefits do not affect the probability that females who have infant children are working during the reference week of the survey; the estimates are positive but insignificant. This might imply that workplace breastfeeding benefits do not affect the length of the maternity leave that married mothers take. This is not surprising, given that the U.S. has no paid maternity leave policies and that mothers can only take a maximum of 12 weeks' unpaid maternity leave. Workplace breastfeeding benefits do not cause mothers to take shorter or longer maternity leaves. Column 6 indicates that among singles, the probability of working during the reference decreased by about 3.2 percentage points; the estimate is statistically significant if males who have infant children are the control group. The fact that labor force participation increased by about 1 percentage points (column 6 panel A) and that the employment rate (column 6 panel B) did not change indicates that fewer singles mothers with infant children worked during the reference week.

Panel D shows that, conditional on working during the reference week, females with infant children worked 3.38% more hours during that week. The mean hours of work for females who have infant children but no access to the workplace breastfeeding benefits is 28.53 ($= e^{3.351}$); workplace breastfeeding benefits increase mothers' hours of work per week by about 1 hour ($= .96 = 28.53 \times 3.38\%$). The effect is negative and not significant for singles, but is very positive and significant for the married sample. When spouse characteristics are controlled for, workplace breastfeeding benefits increase the hours of work per week for the married mothers of infant children by 5.04%. When males with infant children are the control group, the increase is about twice as great—6.49% more hours.

Panel E shows that, conditional on working during the reference week, females who have infant children are less likely to work part-time if they have access to workplace breastfeeding benefits. The probability that the mothers of infant children would work less than 35 hours per week decreased about 3.13 percentage points. Before passage of the law, the mean probability that these women would have a part time job was 43% (column 2 of Table A10); after passage of the law, the probability of their being employed part-time decreased by about 7.3% (= 3.13/43.0 × 100%). The results are driven by the married sample, and in the estimates in which males who have infant children are the control group the results are very robust. Single mothers are more likely to work part-time, although when males with infant children are the control group the results are not significant.

Panel F shows that workplace breastfeeding benefits do not increase or decrease the probability that the females who have infant children were paid hourly wages if they worked during the reference week. Although all estimates are negative, only the one in column 5 is statistically significant (at the 10% level), and its magnitude is small (1.1 percentage points decrease).

Panel G shows that workplace breastfeeding benefits do not significantly affect the hourly wage of females who have infant children, if they were paid hourly during the reference week. All estimates are positive, but none are statistically significant at the 10% level; the large standard errors are the results of the small sample sizes of the number of individuals who earn hourly wages.

These results from Table A11 show the effects on the flow variables when females with infant children are the treated group. Derived from estimating equation (1.4), Table A12 shows the results on the stock variables when the treatment group is females whose youngest child is 1-year old. In Table A12, columns 5-8 are estimated with the alternative control group—that is, males whose youngest child is one year old.

Panel A of Table A12 shows that workplace breastfeeding benefits decreased the probability that females with 1-year olds were employed during their first postpartum year. The effects are driven by the married sample: the probability decreased by about 2 percentage points (column 4) and it is statistically significant at the 1% level; when males whose youngest child is 1 year old are the control group the results are similar.

How can this result be reconciled with those in the Panel A and B of Table A11? The intuition is that workplace breastfeeding benefits are not only associated with an increase in the probability that nursing workers are employed at a typical point during the first postpartum year; they also are associated with a lower probability that nursing workers are employed during the first postpartum year.[12] Workplace breastfeeding benefits allow nursing mothers to increase their employment.

Panel B of Table A12 shows that workplace breastfeeding benefits increased the probability of being employed full-time (working longer than or equal to 35 hours, conditional on being employed) by about 3.9 percentage points, which is statistically significant at the 1% level. Among mothers whose youngest child is one year old, and in the absence of the breastfeeding law, the mean of the probability of being employed full-time is 0.643. When workplace breastfeeding benefits are introduced the probability of having a full-time job increased by 6.1% (= $3.9/64.3 \times 100\%$). The estimates are similar when the control group consists of males whose youngest child is one year old.

Panel C shows a striking result: workplace breastfeeding benefits increased the hourly wage that married mothers received during their first year postpartum by about 4.6% (column 4, statistically significant at 1% level), but they decreased the hourly wage that single mothers received during first year postpartum by about 3.8% (column 2, statistically significant at 10% level). The results are more significant when the control group consists of males whose youngest child is one year old. Combining results in panels B and C, we see that the increase in the hourly wages can be explained by the increase in the probability of working full-time. For married mothers, the magnitudes of the increase in the probability of working full time and the magnitude of the increase in wages are comparable (4.3% and

[12]Mathematically, the former is the derivative of the latter with respect to time. Their relationship can be described as $\frac{dE(t)}{dt} = lfp \times emp(t)$, where $E(t)$ is the amount of employment (unconditional on labor force participation) during the first postpartum year and $lfp \times emp(t)$ is the unconditional probability that the individual is looking for a job at time t. The estimated results suggest that workplace breastfeeding benefits are associated with higher $lfp \times emp(t)$ but lower $E(t)$.

4.6% respectively, column 4), although in the case of single mothers other factors might explain the greater drop in wages (0 and -3.8% respectively, column 2). In the case of married mothers, the change in the probability of working full-time or part-time explains the change in hourly wages that occurs when workplace breastfeeding benefits are in place.

The fact that the effects of workplace breastfeeding benefits differ according to marital status warrants further consideration. Marital status does not affect the impact of breastfeeding benefits on the extensive margins (panels A, B, C, F and G in Table A11 and panels A in Table A12), but affects the impacts on the intensive margins (panels D and E in Table A11 and panels B and C in Table A12). Workplace breastfeeding benefits appear to have the greatest impact on the number of hours worked per day and, thus, on wages. The latter, of course, affect overall labor market outcomes. Within the group that consists of the mothers of infants, workplace breastfeeding benefits might also increase inequality according to marital status.

Marital status can serve as a proxy for high- and low-type workers. The empirical results show that the effects of the workplace breastfeeding benefits differ according to marital status: after passage of the workplace breastfeeding benefits law, wages increased for married mothers and decreased for single mothers. These findings are consistent with those of Pal and Waldfogel (2016). Pal and Waldfogel (2016) found that the most striking effect of the law is a change in the family gap in pay, which is defined as the differential in hourly wages between women who have children and women who do not have children. Between 1967 and 2013, the family gap declined for married mothers and was replaced a positive wage differential. Among unmarried mothers, the wage gap persisted.

Appendix Table A21 shows the estimates of equations (1.3) and (1.4) in the case of a third control group: females without children. The concern is that females without children may control for the common labor market shocks that affect females in general: because they have no children, they are not directly affected by the workplace breastfeeding law. The results are qualitatively similar to those just described, although most of the time the estimates are of a smaller magnitude than those shown in Table A11 and Table A12. This is so because females without children are potentially affected if they and their employers anticipate that they would have children in the future, which would attenuate the treatment effects.

In summary, during the first postpartum year, workplace breastfeeding benefits increased the extensive margins (an increase in labor market participation and no change in conditional employment) of both married and single mothers, and they increased the intensive margin (hours of work) of married mothers but not the intensive margin of single mothers (hours of work). However, in the case of stock outcomes during the first year postpartum, workplace breastfeeding benefits: decreased the extensive margin (unconditional employment) of both married and single mothers; increased the intensive margin (full time) and hourly wage of married mothers; did not affect the intensive margin (full time) of single mothers; and decreased the hourly wage of single mothers. Therefore, in the case of married mothers, workplace breastfeeding benefits increase their hours of work, and, consequently, increased their wages; in the case of single mothers, workplace breastfeeding benefits do not increase their hours of work, and, consequently, decreased their wages.

1.6.4 Robustness checks

Table A13 checks the robustness of the main results for the four outcome variables that are statistically significant and for the married sample. Column 1 is the baseline—that is, the results of column 4 in Table A11. To determine whether the results are driven by certain observations that have extreme values, Column 2 estimates without using weights. To control for the labor market shocks that affect each state each year, Column 3 adds two additional state level covariates that vary by year: the unemployment rate and the growth rate of the GDP. To further control for unobserved factors that affect each state linearly in time, Column 4 adds the state-specific time trends $\theta_s \cdot t$. To control for unobserved shocks that are common for each region each year, Column 5 includes the region-by-year fixed effects, where regions are defined as the Census divisions.

Also of concern is the possibility that other labor policies, such as paid family leave, might be driving the results. California was the first state in the nation to start a paid family leave program (in 2004). The program includes six weeks of partially paid leave to the parents of a newborn or a recently-placed foster or adoptive child. The leave has a wage replacement of 55% up to a ceiling that is based on the state's average weekly wage. Mothers of infant children can use this paid family leave immediately after their maternity leave, which gives them more time for breastfeeding, and many mothers remain on the job to take advantage of the benefit. To determine whether the main effects are driven by the paid family leave law, Column 6 drops the observations obtained in California. As expected, all estimates remain statistically significant, although they have somewhat smaller magnitudes, which is reassuring.

Another concern is that the effects might reflect a change in bargaining power within couples; for example, a female might experience an increase in bargaining power relative to that of her spouse. This might lead to the spouse becoming more involved in childcare and other domestic responsibilities, which could give the mother of the infant children more incentive to work. Consequently, in the subsample of married couples in which both the husband and the wife report an hourly wage, I calculate the wage gap (the ratio of the wife's wage to the husband's wage) and include it as an additional covariate. Column 7 reports the estimates. The effect of the probability of being paid an hourly wage becomes negative and is statistically significant; the real hourly wage during the previous year becomes statistically insignificant. It would seem that bargaining power within couples affects part of the effects on wages.

Yet another concern is the possibility that the cultural shift during the past two decades in culture in favor of breastfeeding might explain the results. Column 8, which shows the robustness check, adds dummy variables that indicate three other state-level mandates related to breastfeeding ($AnyPlace_{st}$, $Jury_{st}$ and $Indecency_{st}$) and their interaction terms with the $Mother_{ist}$ in equation (1.3). In the case of labor force participation (panel A), the estimate for workplace benefits is positive but not significant; the effects are picked up by the other three laws, which suggests that at least part of the effect of workplace breastfeeding benefits coincides with effects from these three other mandates. Adding the combined effects of all four benefits, the labor force participation still increases statistically, which suggests that the breastfeeding mandates together have increased the extensive margin of the flow outcomes. In the case of the hours of work (panel D), the estimate for workplace breastfeeding benefits remains positive and is statistically significant, which suggests that the effects on the intensive margin are robust to the inclusion of the other three mandates. In the case of employment last year (panel H), the estimate for workplace breastfeeding benefits remains negative and is statistically significant, which suggests that the effects on the extensive margin of the stock variable are robust to the inclusion of the other three mandates. In the case of full-time employment last year, the estimate of workplace breastfeeding benefits is no longer significant; it seems that its effect is picked up by the "Any place" mandate, although all four breastfeeding mandates increased the intensive margin of the stock variable. Similarly, the effects on the log hourly wage last year are picked up by the "Any place" mandate, and the four breastfeeding mandates significantly increased last year's hourly wage. In summary, in the case of certain outcome variables, the effects of workplace breastfeeding coincide with the effects of the three other state-level breastfeeding mandates. Yet because of the correlation of the passage of the four mandates, the direction and magnitude of the effects on the outcome variables are robust.

1.6.5 Threats to identification of effects on labor market outcomes

1.6.5.1 Existence of pre-trends: alternative specifications using event-study frameworks Because the main specification of a DDD framework might not capture the dynamic impact of the benefits—for example, anticipation effects might precede the implementation of the law, or it might take years for the labor market impact to he expressed—I use in this section another framework, the event-study framework, with leads and lags of the law dummies, to investigate the dynamic impact of workplace breastfeeding benefits. Also, using the event-study frameworks, I present visual evidence of the effects of workplace breastfeeding benefits. In this section the sample includes only married individuals because the married sample drives the main results.

The event-study specification is of the form

$$\begin{aligned} y_{ist} &= \alpha + Mother_{ist} + \sum_{\tau=-5}^{-1} Workplace_{\tau,st} + \sum_{\tau=1}^{8} Workplace_{\tau,st} \\ &\quad + \sum_{\tau=-5}^{-1} \delta_\tau Workplace_{\tau,st} \times Mother_{ist} + \sum_{\tau=1}^{8} \eta_\tau Workplace_{\tau,st} \times Mother_{ist} \\ &\quad + X_{ist}^{'}\Gamma + \theta_s + \theta_t + \epsilon_{ist}, \end{aligned} \tag{1.5}$$

where the variable $Workplace_{\tau,st}$ equals 1 if during year t, state s occurs τ years after the enactment of the breastfeeding law and if τ ranges from -5 to 8. The year of the enactment ($\tau = 0$) is the omitted category and the effect is zero. $x = -5$ denotes the years 5 or more than 5 years before the enactment of the workplace breastfeeding law. $x = 8$ denotes the years 8 or more than 8 years after the enactment of the law. For example, $Workplace_{-3,st}$ means that state s during year t is three years prior to the enactment of the breastfeeding law. The definition of $Mother_{ist}$ remains the same; it equals 1 if the individual is a female who has an infant child and it equals 0 if the individual is male.

Figure A9 plots the event-study estimates of the yearly effects of the workplace breastfeeding support law on the extensive margin of the flow outcomes. The x-axis denotes the number of years since the passage of state-level workplace breastfeeding mandates. The y-axis plots the estimates of the δ's and η's in equation (1.5) for labor force participation. Before the enactment of the breastfeeding law, although the estimate of δ_{-5} is both negative and statistically significant, the effects of the law are close to zero. From the fact that the curve is relatively flat I conclude that there is no existence of a pre-trend. During the first year after the law's enactment, the effect became much larger, and four years later it became statistically significant. Five years after passage of the law, the effect is negative, although it is estimated with a much larger standard error. The effects for η_7 and η_8 are positive and statistically significant at the 95% level. After enactment of the law, there is an increasing trend in its annual impacts.

Similarly, Figure A10 plots the event-study estimates of the yearly effects of the workplace breastfeeding support law on the intensive margin of the flow outcomes. In the case of log hours work and the log hourly wage if paid hourly, the marginal effects before the law are small and close to zero, but after the law the effects show a clear pattern of growth. In the case of the probability of working part-time, the marginal effects prior to the passage of the law are positive, but after the law all of the effects are negative.

Finally, Figure A11 plots the event-study estimates of the yearly effects of the workplace breastfeeding support law on stock outcomes. The most striking results are the estimates of the effects on the probability of being employed last year: after the mandates a significant reduction occurs.

1.6.5.2 Selection on pregnancy and other observables In an alternative explanation, the estimated results could be driven by a compositional change in the sample of females who have infant children. We wish to know whether females who have infant children and who live in state-years with and without workplace breastfeeding benefits are characterized by a statistically significantly difference in their observed individual level characteristics. To this end, we estimate the following equation:

$$x_{ist} = \alpha + \beta Workplace_{st} + \theta_s + \theta_t + \epsilon_{ist}. \tag{1.6}$$

The dependent variable is one of the following individual-level characteristics: age, nonwhite, education (high school dropouts, high school graduates, some college, and college graduates), married status, the log of real household income, spouse's age, the spouse's education levels, whether spouse is in the labor force, whether the spouse is non-white, and whether the infant is a first child. The explanatory variable is the $WorkplaceLaw_{st}$ dummy. Year- and state-fixed effects are included in order to control for the common shocks for each year and for each state.

To determine whether the results of the flow variables are driven by selection, Table A14 shows the balance check of the observed characteristics of females who have infant children. To determine whether there is a selection for living in a state that has the law, Panel A checks the balance among all females who have infant children. To determine whether among those participating in the labor force there is a selection for living in a state that has the law, Panel B includes females who have infant children and are in the labor force. To determine whether among women who resume working post-birth there is a selection for living in states that have the law, Panel C looks at females who have infant children and whose hours of working per day during the reference week are known. To determine whether among those who earned hourly wages during the reference week there is a selection for living in a state that has the law, Panel D looks at females with infant children whose hourly paid wages are known.

Across panels, the estimates for the variable "high school dropouts" are both negative and statistically significant, which suggests that fewer mothers who have the least education participate in the labor market when the breastfeeding law is in effect. Similarly, in all panels except for the last one, mothers who live in states that have breastfeeding mandates are associated with a higher level of household income, which is not surprising: mothers from wealthier households are more likely to work, but they are less likely to receive hourly paid wages.[13]

[13]In the main results, the covariates do not include household income. The results are largely the same when income is included as an additional covariate. Appendix D shows the results.

Other types of sorting also affect the extensive margin and the intensive margin. In panel A, mothers who live in states that have breastfeeding laws are associated with a higher probability of having received a high school degree. This is plausible given that workplace breastfeeding benefits increase labor force participation rates. In panel D, however, mothers who live in states that have breastfeeding laws and receive an hourly paid wage are associated, first, with a higher probability of being non-white and, second, of being married to a non-white spouse. Given that the negative selection bias affects the hourly wages downward, the true effects of workplace breastfeeding benefits on hourly wages (paid by the hour) should be more positive and larger. Across the panels, there seems to be no selection with regards to age, the child's status as a first child, the spouse's age, or the spouse's labor force participation status.

In summary, females who have infant children and in live in states that offer the breastfeeding benefit are less likely to be high school dropouts and are more likely to be new mothers. Those who have a higher than average attachment to the labor force tend to come from households that have higher real incomes.

To see if the results on the stock variables are driven by selection, Table A15 shows the balance check of the observed characteristics for females whose youngest child is one year old. The main dimensions of sorting remain the same, though there appears to be more selection among this sample of females whose youngest child is one year old than among the sample of mothers of infants. That the selections are same across the samples defined conditionally for all outcome variables, suggest that the interpretation about the effects on the conditional variables should be similar to the interpretation about the effects on the unconditional variables.

1.7 CHANNELS

1.7.1 Detailed requirements of state mandates

To investigate the potential channels of the impact of workplace breastfeeding benefits on labor market outcomes, I exploit in this section inter-state variation in the degree of specificity of the benefit regulations. Table A16 shows the results using alternative definitions of the workplace breastfeeding law ($Workplace_{st}$), as specified in equation (1.3). In Table A16, each panel examines a different dimension of the mandate. In all regressions, $Workplace_{st}$ equals 1 if state s during year t passed a "stronger" version of the workplace breastfeeding mandate; if these states have not yet passed the law, and in states that have never passed a version of the mandate, $Workplace_{st}$ equals 0.

Most states require that the benefits should be provided for one year. However, five states (Colorado, Maine, New York, Oregon, and Vermont) require a longer period (from 18 months to 36 months). In all panels Column 1 compares labor market outcomes in these states and in states that have never passed the law; the objective is to see how these estimates differ from the estimates provided in my main results. A striking result, shown in Panel B, is the estimate of the probability of being employed conditional on the labor force. Here the estimate is positive and statistically significant at 1 percent level, which suggests that when mothers are entitled to breastfeeding breaks at the workplace for more than one year, the impact on the probability of being employed conditional on the labor force increases by about 1.43 percentage points. This insignificant impact on the main results could indicate that the duration of the benefits is too short. In Panel E, the estimate of the increase in the log hours of work (increased by about 9.8%) is almost double that of the main effect (5.04%). In Panel G, the hourly wage (if paid hourly) increased by about 2%; in the main results the increase was insignificant. In Panel H, the employment (stock) does not decrease; this finding contrasts with the main results, which show that employment last year did not decrease significantly. Finally, in Panel J, the hourly wage last year increased by about 8.12%; in the main results the increase is only 4.6%. In summary, giving women the workplace breastfeeding benefit for more than one year significantly improved the labor market outcomes of nursing mothers, particularly in the case of employment outcomes, during both the reference week and the first postpartum year.

In most states women are only allowed to pump breast milk and only during break time, but four states (Connecticut, Oklahoma, Oregon and Rhode Island) allow both pumping and breastfeeding. As shown in Column 2, the effects are not statistically significant except in the case of labor force participation (a smaller magnitude than the main results) and the log hourly wage last year (a much larger magnitude than the main results). This result would seem to indicate that allowing both breastfeeding and pumping has little effect on outcomes because most nursing workers use breaks for pumping.

Some states clearly state that employees who request breastfeeding breaks at the workplace should not suffer discrimination. The states are Connecticut, D.C., Hawaii, Maine, Mississippi, Montana, New York, Vermont and Washington. The results are shown in Column 3. In contrast to the main results, Panel B shows that when discrimination is prohibited, and conditional on in the labor force, the probability that females with infant children will be employed increases by about 1.05 percentage points. Panel H shows that employment last year decreased by about 1.06 percentage points, which is about half of the decrease seen in the main results. In other words, prohibiting discrimination against nursing employees at the workplace increases employment both during the reference week and during the first postpartum year. Moreover, the hourly wage last year also increased by a modestly larger percentage than the base line results.

Some states provide retaliation protection for whistle-blowers who report discrimination and violation of the law (Maine, Minnesota, New York, Tennessee and Vermont). Column 4 compares labor market outcomes in these states to states that have never passed the law. Most striking are the results for (1) the probability of working during the reference week, conditional on having a job (panel C), and (2) the probability of receiving an hourly paid wage (panel F). The results suggest that when workplace breastfeeding rights are protected by law, women who have infant children (1) will be about 1.57 percentage points less likely to work during the reference week (i.e., perhaps more likely to take a longer maternity leave) and (2) will be about 3 percentage points more likely to receive hourly paid wages. This probably is the product of two processes. First, employers who are likely to discriminate against nursing employees or who violate the law tend to provide shorter maternity leaves. Second, prohibiting discrimination has the unintended consequence of forcing more nursing workers to find hourly jobs.

Finally, some states that do not require the provision encourage employers to provide the benefits or allow the employer to include "baby-friendly" or "infant-friendly" designations in their promotional materials. Such states include North Dakota, Texas, Virginia, Washington and Wyoming. The results are shown in Column 5. Compared to my main results, the breastfeeding benefit in these states is associated with a significant reduction of the probability of being employed (panel B), a significant reduction in the probability of receiving hourly paid wages (panel D), a substantial increase in the hourly paid wage (panel G), and a somewhat smaller increase in the hourly wage last year (panel J). This result is consistent with another finding: that where providing breastfeeding benefits are voluntarily, employers are more likely to hire fewer workers. This, in turn, suggests that if employers can legally avoid paying the additional costs, they will respond in the extensive margin. Yet in keeping with our model, and conditional on hiring these workers, employers still pay a significantly higher wage. This, too, constitutes clear evidence of the differential responses to workplace breastfeeding benefits, whether on the extensive or the intensive margins.

In summary, requiring that workplace breastfeeding benefits be provided for more than one year and prohibiting discrimination against employees who request breaks significantly improves the employment of nursing mothers, both during the reference week and during the first postpartum year. Allowing both breastfeeding and pumping does not seem to have much of an effect on female labor force participation. However, in terms of their effects, the difference between requiring retaliation protection and simply encouraging voluntary workplace breastfeeding benefits is very significant: employers may wish to hire fewer nursing workers, but conditional on hiring, those females who do work tend to work longer hours and receive higher wages.

1.7.2 Temporal flexibility of occupations

In this section, I look at the features of the workplace environment in order to explore the possible channels of the impact. Consider the costs of providing the benefits across different occupations. Whether a woman can take any breastfeeding break or two to three breaks of 20 to 30 minutes each depends on the temporal flexibility of her job. As Goldin (2014) argues, how flexible an occupation is with respect to the number of hours worked, the precise times worked, and the predictability and ability to schedule one?s own hours affects whether it is relatively easy for the worker to be excused from work without interrupting the work flow or disturbing the coworkers. To proxy how costly it is for the employer to provide the workplace breastfeeding benefits, I use five characteristics of occupations categorized in version 20.3 (released April 2016) of the Occupation Information Network (O*NET) database.

The O*Net dictionary includes hundreds of occupational characteristics. I adopt the five characteristics in the categories of "work context" and "work activities", following Goldin (2014): time pressure, contact with others, establishing and maintaining interpersonal relationships, structured versus unstructured work, and freedom to make decisions.[14]

[14] The following definitions describe the five characteristics: (1) Time pressure: How often does this job require the worker to meet strict deadlines? (2) Contact with others: How much does this job require the worker to be in contact with others—i.e., face-to-face, by telephone, or otherwise—in order to perform it? (3) Establishing and Establishing and maintaining interpersonal relationships: Developing constructive

The variable $LessFlexibility_i$ is defined as the average of the five characteristics for each occupation. I merge the occupational characteristics for individuals whose occupational is known in the CPS sample. Table A17 shows the Summary statistics of the occupational characteristics.[15] Table A17 shows that in the case of women who have an infant child, the workplace under breastfeeding benefits seems to be associated with more flexibility (a mean of .137 versus .0725); the same holds in the case of women whose youngest child is one year old. However, in the case of males, the workplace under breastfeeding benefits seems to be associated with less flexibility (a mean of -.035 versus -.050).

To determine whether the impact of the workplace breastfeeding benefits moves through the channel of the temporal flexibility of occupations, I estimate the following equation

$$\begin{aligned} y_{ist} &= \alpha + \beta_1 Workplace_{st} + \beta_2 Mother_{ist} + \beta_3 LessFlexibility_i \\ &+\beta_4 Workplace_{st} \times Mother_{ist} + \beta_5 Workplace_{st} \times LessFlexibility_i \\ &+\beta_6 Mother_{ist} \times LessFlexibility_i \\ &+\beta_7 Workplace_{st} \times Mother_{ist} \times LessFlexibility_i \\ &+X'_{ist}\Gamma + \theta_s + \theta_t + \epsilon_{ist}, \end{aligned} \tag{1.7}$$

where parameter β_4 captures the main effects of the workplace breastfeeding benefits.

The parameter of interest is β_7, and it can be interpreted as whether within each industry difference in the temporal flexibility of occupations affects the impact of the workplace breastfeeding benefits on the female workers' labor market outcomes. Because the occupations are primarily determined by an individual's human capital, workers are not

and cooperative working relationships with others, and maintaining them over time. (4) Structured versus unstructured work: To what extent is this job structured for the worker; i.e., does it allow the worker to determine tasks, priorities, and goals? (5) Freedom to make decisions: How much decision making freedom, without supervision, does the job offer.

[15]The occupation variable in the CPS is "occ2010." I use the crosswalk between "occ2010" and "2010SOC" to link the occupation to its characteristics in O*NET. Because O*NET occupations are cross-referenced by industry, I weigh the detailed occupation characteristics by the number of observations in each occupation. This allows me to match the characteristics to the CPS occupations. Then, following the approach outlined by Goldin (2014), I normalize the characteristics to arrive at a mean of zero and a standard deviation of 1.

likely within one year of giving birth to sort across occupations on the basis of unobserved factors that also affect their labor market outcomes. Controlling for industry-fixed effects (included in the vector X_{ist}), the variable $LessFlexibility_i$ is plausibly orthogonal to the error term ϵ_{ist}. If β_7 is statistically significant, the workplace breastfeeding support will affect workers' labor market outcomes through the temporal flexibility of their occupations.

Table A18 shows the estimates for β_4 (the main impact of workplace breastfeeding benefits) and β_7 for different labor market outcomes. The regressions are estimated for the sample of the married with the covariates of the spousal characteristics. Column 1 shows the estimates of equation (1.7) for different outcomes. To better understand which dimension of the flexibility drives the results, I replace the $LessFlexibility_i$ in equation (1.7) with each of the five characteristics. The estimates of β_4 and β_7 are shown in columns 2-6.

In Panel A, the estimates of the parameter precedes $Workplace_{st} \times Mother_{ist}$ are positive in all columns, which is reassuring. The estimate for β_7 in Column 1 is negative and is statistically significant at the 1% level. This suggests that a one-standard deviation in the dimension of "less time flexibility" decreases the impact of workplace breastfeeding benefits on labor force participation by about 1.11 percentage points; this is about half the reduction of the main effects (2.13, estimate for β_4 in row 1). The estimates in columns 2-6 show that the effects seem to come from the "time pressure," "contact with others," and "structured workplace."

Similarly, in Panel D, the estimates for β_4 are positive in all columns, which is reassuring. The estimate for β_7 in Column 1 is positive and statistically significant at the 5% level. This finding suggests that a one-standard deviation in the dimension of "less time flexibility" increased the impact of workplace breastfeeding benefits on the log hours of work by an additional 3.1%, which is about two thirds of the increase that comes from the main effects (4.26%, estimate for β_4 in row 1). This result confirms Proposition 2's prediction that if the employer faces a higher cost of providing the benefits (less time flexibility), the effects of the benefits on the hours of work will be larger still (a 3.1% larger increase on the hours of work). The estimates in columns 2-6 show that the effects seem to come from the dimension of "establishing relationships."

In Panel H, the estimates for β_4 once again are positive in all columns; although the estimate for β_7 in Column 1 is not statistically significant, the estimate for β_7 in column 6 is positive and it is statistically significant at the 5% level. This result suggests that a one-standard deviation in the dimension of "freedom of making decisions" increased the impact of workplace breastfeeding benefits on the log hourly wage last year by an additional 2.24%, which is about a half of the increase that comes from the main effects (4.38%, estimate for β_4 in row 1). This result shows that although the theory makes no prediction about the comparative statics for the hourly wage with respect to the cost of providing the benefit, the effects of the benefits on the hourly wage will be larger still if the higher cost is due to the freedom to make decisions.

In summary, in the case of occupations that have less flexibility, the increase in labor force participation is smaller, the increase in hours of work is larger, and the increase in the probability of working full-time is larger, than the changes when the occupations have more flexibility. That these findings are consistent with those of Goldin (2014) demonstrates that firms reward individuals who are willing to work long hours and particular hours. Jobs that entail less temporal flexibility often require higher human capital and are winner-take-all positions; they also are positions for which considerable work hours lead to a higher chance of promotion and a larger reward.

1.7.3 Alternative channels

Other characteristics at the workplace might have affected the impacts of workplace breastfeeding benefits. Among these is the concern that firm size (the number of employees in the firm) might affect the cost of providing benefits. Still another is the concern that firm location—for example, whether the firm locates in a central city—could affect costs. Furthermore, an employer's willingness to provide workplace breastfeeding benefits might be affected by whether the workplace has a high turnover (whether the worker has more than one employer during the last year). To rule out these alternative explanations I examine whether their interaction term with $Workplace_{st} \times Mother_{ist}$ is significant. To this end, I replace $LessFlexibility_i$ with individual-level variables that capture other dimensions of the workplace environment. The dummy variable $LargeFirm_i$ equals 1 if the individual's firm has more than 99 employees; the dummy variable $CentralCity_i$ equals 1 if the individual lives in a central city (conditional on whether the metropolitan status information is known); and the dummy variable $ChangeEmployer_i$ equals 1 if during the last year the individual has had more than 1 employer (conditional on her having had at least one employer).

Yet another concern is that the results might be driven by unobserved shocks on child care costs, which would affect the opportunity costs of using breastfeeding breaks at the workplace. I estimate whether the effects differ in accordance with childcare costs, which are proxied by the number of individuals in the CPS sample who work in childcare occupations (variable "occ1990" equals 468) and the number of workers who work in the childcare industries (variable "ind1990" equals 862 or 863), by state-year level.

Table A19 shows the estimates for the married sample with spouse covariates. For a few outcomes, the interaction term β_7 could be significant, but the estimates, such as random estimates for β_4, are not robust. It is plausible to conclude that these dimensions do not capture the main effects of the workplace breastfeeding benefits.

1.8 ADDITIONAL EFFECTS OF THE BENEFITS

1.8.1 Lagged effects

Several years after the law's initial enactment, does the law still affect females who have infant children? That is, are the effects simply a one-time shock or do they permanently change the interaction between nursing workers and firms? I use the following specification to estimate the lagged impact of the workplace breastfeeding benefits:

$$\begin{aligned} y_{ist} = \alpha + \beta_1 Workplace_{s,t-k} + \beta_2 \text{Mother of infant child}_{ist} \\ + \beta_3 Workplace_{s,t-k} \times \text{Mother of infant child}_{ist} + X_{ist}^{'}\Gamma + \theta_s + \theta_t + \epsilon_{ist}, \end{aligned} \quad (1.8)$$

where the dummy variable $Workplace_{s,t-k}$ equals 1 if state s during year $(t-k)$ passed the workplace breastfeeding mandate (otherwise it is 0) and where $k \in \{0, 1, \cdots, 7\}$. The dummy variable Mother of infant child$_{ist}$ equals 1 if the youngest child of individual i is 0 years old, and it equals 0 if the individual is male.[16] The parameter of interest is β_3, which can be interpreted as the lagged effects of the workplace breastfeeding benefits k years after the state has enacted the mandate.

1.8.2 Spill-over effects

The spill-over effects can be estimated using the following specification:

$$\begin{aligned} y_{ist} = \alpha + \beta_1 Workplace_{st} + \beta_2 \text{Mother of k years old}_{ist} \\ + \beta_3 Workplace_{st} \times \text{Mother of k years old}_{ist} + X_{ist}^{'}\Gamma + \theta_s + \theta_t + \epsilon_{ist}. \end{aligned} \quad (1.9)$$

[16] To conserve space in the equation of the lagged, spill-over and dynamic effects, I only present the specification for the flow outcome variables; the specification for the stock variables is adjusted accordingly, and it is omitted here.

where the parameter of interest is β_3; it can be interpreted as the spill-over effects of workplace breastfeeding benefits for females whose youngest child is k years old.

Through several channels we may observe the spill-over effects in the case of women whose youngest child is older than 0 year old. First, the worker may anticipate that in the future she will enjoy the benefits if she has another child, and this may lead her to be less likely to give up work. Second, the employer, too, can anticipate the change and treat females who have older children in the same manner that they treat females who are breastfeeding. Finally, because of the general equilibrium effects, other workers, too, will experience some effects, although the specific directions and magnitudes of these effects have yet to be established through empirical research.

1.8.3 Dynamic effects

Equation (1.3) identifies the contemporaneous effects of workplace breastfeeding benefits on females who have infant children—that is, the effects on females during their first postpartum year. One might be curious about whether the effects persist—for example, does having access to workplace breastfeeding benefits during the first postpartum year continue to affect the labor market outcomes of females two or three years after giving birth?

I use the following specification to estimate the dynamic impact of workplace breastfeeding benefits:

$$\begin{aligned} y_{ist} = {} & \alpha + \beta_1 Workplace_{s,t-k} + \beta_2 \text{Mother of k years old}_{ist} \\ & + \beta_3 Workplace_{s,t-k} \times \text{Mother of k years old}_{ist} + X_{ist}^{'}\Gamma + \theta_s + \theta_t + \epsilon_{ist}, \end{aligned} \tag{1.10}$$

where the dummy variable $Workplace_{s,t-k}$ equals 1 if state s during year $(t-k)$ has passed the workplace breastfeeding mandate; otherwise it is 0. $k \in \{0, 1, 2, \cdots, 7\}$. The dummy variable Mother of k years old$_{ist}$ equals 1 if the youngest child of individual i is k years old and it equals 0 if the individual is male. The parameter of interest is β_3, which can be interpreted as the effects of workplace breastfeeding benefits k years after the state enacted the mandate. The hypothesis is that having access to workplace breastfeeding support during the first postpartum year (k years ago, when the female was still nursing her child) impacts a mother's labor market outcomes during later years (when her child is k years old). Note that when $k = 0$, equation (1.10) is the same as the equation (1.3); the latter describes the contemporaneous effects of the benefits.

Why might we observe dynamic effects several years after the law has been implemented? Several explanations come to mind. First, several years after implementation of the law the productivity of workers could be higher because firm-specific human capital has been acquired. Second, due to the sticky wage effect, firms might adjust wages later. Finally, some psychological and health benefits might emerge only over the long term. It is reasonable to expect dynamic effects because of path-dependence.

1.8.4 Comparing the spill-over, dynamic and lagged effects

Figure A12 to Figure A21 show the relative magnitudes of the spill-over, dynamic, and lagged effects on all outcome variables of interest. With regards to spill-over effects, the y axis denotes the estimates for β_3 in equation (1.9) for $k \in \{0, 1, 2, \cdots, 7\}$; for the long-term effects, the y axis denotes the estimates for β_3 in equation (1.10) for $k \in \{0, 1, 2, \cdots, 7\}$. The x-axis denotes the k in the variable $Workplace_{s,t-k}$ and Mother of k years old$_{ist}$, $k \in \{0, 1, 2, \cdots, 7\}$. For the lagged effects, the y axis denotes the estimates for β_3 in equation (1.8) for $k \in \{0, 1, 2, \cdots, 7\}$. The x-axis denotes the k in the variable $Workplace_{s,t-k}$, $k \in \{0, 1, 2, \cdots, 7\}$. For example, Figure A12 shows that a positive and stable effect of the lagged effects lasts for years. The spill-over and the dynamic effects track each other: both are significantly smaller than the lagged effects but both decrease in k. Similarly, A19 shows that a negative and stable effect of the lagged effects persists across the years.

The spill-over and the dynamic effects track each other: both are significantly less negative than the lagged effects, and the magnitudes of both decrease in k.

In summary, the dynamic effects of the law account for at least some of the spill-over effects. In the case of the extensive margin (labor force participation and employment last year) we can clearly separate the main effects of the mandates from the spill-over effects: certain shocks that are specific to the mothers of infants (rather than females with older children) remain statistically significant for up to eight years after the law's enactment.

1.9 CONCLUSION

This paper looks at how workers' employment and wages in the U.S. have been affected by workplace breastfeeding benefits that have been mandated by law. From 1995 to 2009, about half of all states passed mandates that require employers to provide unpaid break time and a special private space so that nursing employees can express milk at the workplace. Mothers enjoy this benefit for a period of one to three years after giving birth.

I argue that workplace breastfeeding benefits increase the cost to firms of hiring and reduce the cost to young mothers of breastfeeding. A simple extension of the standard framework indicates that if firms are willing to increase the labor demand for mothers who are most productive, mandated benefits can increase the demand for and the supply of the mothers of infants, which, in turn, increases the wages of and, in all likelihood, the work attachment of these women.

Consistent with these expectations, the empirical results suggest that workplace breastfeeding benefits increase the duration of breastfeeding, although the impact on the initiation of breastfeeding is insignificant. The labor force participation of mothers of infants increases. Married mothers work longer hours and receive a higher wage, although single mothers do not work longer and receive a lower wage. The results are robust to alternative specifications, including the event-study framework for the labor market outcomes and hazard models for the duration of breastfeeding. Analyzing the detailed requirements of the state mandates, I show that the effects work through the differential interactions of the extensive and intensive margins, and I find evidence of discrimination. I present evidence that the effects work through occupational differences in temporal flexibility.

The empirical results suggest that workplace attitudes about breastfeeding causally affect the duration of breastfeeding and the extensive and the intensive margins of labor market outcomes. My finding that workplace breastfeeding benefits increase the hourly wages of females who have infant children runs counter to the general theory that states that mandated benefits depress wages (Summers, 1989; Gruber, 1994).

My findings do not address the efficiency and welfare consequences of workplace breastfeeding benefits. My model is a partial-equilibrium model: the workers consist only of the mothers of infants. Although the model provides no prediction about the general equilibrium effects, the empirical results show that spill-over effects are limited: workplace breastfeeding benefits also affect the labor market outcomes of females who have older children, perhaps because of the existence of the dynamic effects, including anticipation effects. Nonetheless, analysis of workplace breastfeeding support reveals that the impact of labor market outcomes on the mothers of infants persists for up to eight years after enactment of the law.

That fact that providing workplace breastfeeding support can be mutually beneficial to both the employee and the employer suggests that public policies are needed to educate and incentivize employers to be more willing to provide that support. Because it allows more nursing employees to work more and receive a higher wage, workplace breastfeeding benefits would seem to constitute a step towards the promotion of gender equality in the corporate world. Women might be able to "have it all" (more breastfeeding and more working) if employers provided a more supportive environment at the workplace. The empirical evidence suggests that providing these benefits for more than one year and prohibiting discrimination and retaliation improves the labor market outcomes of nursing workers.

My findings predict that in states that have not yet passed comparable mandates the Affordable Care Act would improve the breastfeeding and labor market outcomes of women who have infant children. To estimate the impact of the ACA's workplace breastfeeding support mandate, researchers could use these states as the treated group, and they could use states that have already passed versions of the mandate as the control group. To study the impact of these benefits on employers, future researchers might want to analyze matched employer-employee data.

2.0 PATIENT COST-SHARING AND HEALTHCARE UTILIZATION: EVIDENCE FROM THE ACA'S MEDICARE PREVENTIVE BENEFITS

2.1 INTRODUCTION

How do prices paid by consumers affect their health care utilization? Economic theories of health insurance has shown that because of the moral hazard, people would behave riskier and increase the health care usage, if they bear a lower cost of health services. The famous RAND Health Insurance Experiment (HIE) found that higher patient payments significantly reduced medical care utilization. However, the HIE evidence is in the eighties and excludes the elderly from the experiment (Chandra et al., 2010). Therefore, this paper investigates the effects of prices on health care usage among the elderly.

The empirical literature has found evidence of price sensitivity in the use of office visits, emergency room use, prescription drug use, and overall spending, among the elderly. For example, Chandra et al. (2010) examined the copayment changes of the California Public Employees Retirement System, and found that both physician office visits and prescription drug utilization are modestly price sensitive among the elderly, and they find significant "offset" effects in terms of increased hospital utilization in response to the combination of higher copayments for physicians and prescription drugs.

However, the previous research has not covered a key component of the health care utilization: preventive care. Preventive care includes health services like screenings, checkups, and patient counseling that are used to prevent illnesses, disease, and other health problems, or to detect illness at an early stage when treatment is likely to work best. Because preventive services detect early signs of more serious illness and improve people' health, using more preventive services, though increase the costs, would significantly decrease the future medical costs, thus is beneficial to the society on the whole. There has been relatively little evidence about the moral hazard in preventive services.

Therefore, this paper studies the effects of patient cost-sharing on the usage of preventive services in this cohort, exploiting the removal of copayment and coinsurance of Medicare-covered preventive services that are recommended by the US Preventive Services Task Force, as a part of the reform of Affordable Care Act (ACA). On January 1, 2011, about ten types of preventive services to Medicare beneficiaries became free for the patients. These preventive services, which are rated A or B by the US Preventive Services Task Force, include several cancer screening, major chronic condition screening and self-management training, etc. At the same time, the Medicare began to cover some new preventive services, with newly created procedure codes, such as the depression counseling, tobacco use cessation counseling, and annual wellness visit (Centers for Medicare & Medicaid Services, 2015). Before the implementation of Medicare Preventive Benefits (hereafter MPB), Medicare beneficiaries paid 20% coinsurance of the Medicare-approved rate for preventive services covered by Medicare Part B.

The empirical challenge to study the MPB is that the policy change applies to all Medicare beneficiaries; there exists no comparison group. However, the knowledge of the new benefits and the preference of using preventive services vary across individuals. Following the intuition in Chetty et al. (2013) that individuals with no knowledge of certain policies behave as they would in the absence of the policy, we categorize individuals on the basis of their potential knowledge of this new Medicare benefits reform. In particular, we calculate the take-up rate of a new service started at the same time of the implementation of the MPB: the Annual Wellness Visit (hereafter AWV), for each of the 306 Hospital Referral

Regions (hereafter HRRs).[1]

The take-up rate of the AWV service is a good proxy for the awareness of the policy change, because during a wellness visit, a beneficiary can develop or update a personalized prevention plan based on his/her current health and risk factors. This visit includes a health risk assessment, a review of medical and family history, some routine measurements, and a screening schedule for appropriate preventive services.[2] Therefore, it is reasonable to assume that in a region where people are more likely to use this newly available (same starting time as the time preventive services become free) service that evaluates the overall health of a beneficiary, the people in the region is also more likely to know about the MPB reform, and respond by using more preventive services, due to the "Law of Demand".

It is better to measure the take-up rate of the AWV at the area level instead of using whether the individual used the AWV to predict the usage of the other preventive services, because our goal is to evaluate the responsiveness of the preventive care with respect to the removal of patient costs, and not about the relationship between the general (AWV) and specific preventive care usages per se. By proxying the knowledge of the reform using the HRR level take-up rates of the AWV, we can causally evaluate how removing patient cost-sharing affects the usage of preventive service, under the identifying assumption that people in regions with no knowledge of the reform act as control groups to the people in regions with higher knowledge of the reform.

To further understand the source of the knowledge of the MPB, i.e., whether it comes

[1]Hospital referral regions represent regional health care markets for tertiary medical care that generally requires the services of a major referral center. The regions were defined by determining where patients were referred for major cardiovascular surgical procedures and for neurosurgery. Each HRR has at least one city where both major cardiovascular surgical procedures and neurosurgery are performed. See more details at http://www.dartmouthatlas.org/data/region/.

[2]The AWV includes a personalized prevention plan of service (PPPS). The AWV is not a "routine physical checkup that some seniors may get every year or so from their physician or other qualified non-physician practitioner. (Medicare does not cover routine physical examinations.) The AWV does not include any clinical laboratory tests, but a referrals for such tests can be made as part of the AWV, if appropriate. Medicare waives both the coinsurance or copayment and the Medicare Part B deductible for the AWV.

from the beneficiaries' health, preferences and behavior such as reading newspapers (demand-side factors), or from the changing attitudes or practice of the physicians, hospitals and local neighborhoods (non-individual factors, hereafter referred to as the supply-side factors), we isolate the demand-side factors (at individual level) from the supply-side factors (at the HRR level) using the sample of beneficiaries who moved between HRRs after the implementation of the MPB. Consider the average change of usage among beneficiaries who move from a low-knowledge HRR to a high-knowledge HRR: if the usage increases to the level of usage at the destination HRR, the knowledge comes from supply-side; if the usage remains similar to that at the origin HRR, the knowledge comes from the demand-side. Therefore, we exploit the sample of beneficiaries who stayed in the same HRR during 2011 and 2012, but moved to a different HRR in 2013. We track the change of AWV (and other preventive services) usage between 2012 and 2013, and see whether the change can be explained by the origin HRR's AWV take-up rate or the destination HRR's AWV rate. Our results show that for most of the services, the change of usage is explained by the origin HRR's AWV rates, therefore, the knowledge is driven by the demand-side factors.

We then estimate the effects of removing patient cost sharing on the usage of preventive services, using the 2008-2013 5% random sample of the historical claims of all Medicare beneficiaries, three-year pre and three-year post policy change. The sample includes beneficiaries who are 65 years and older, who have continuous enrollment of Part A and Part B, and 0 months of HMO, and who are alive as of December 31, 2013. Using a difference-in-differences framework, we find that the price sensibility varies in different preventive services. In particular, the most price-sensitive service is the abdominal aortic aneurysm screening (or aaa screening), screening mammogram and two types of tests for colorectal cancer (colonoscopy used among beneficiaries with average risks for colorectal cancer, and the fecal occult blood test, or FOBT). Furthermore, the out-of-pocket payments do not seem to be the major barrier of usage for the bone mass measurement, medical nutritional therapy, hepatitis B vaccination, pap tests, pelvic tests, and other types of colorectal screening tests such as flexible sigmoidoscopy. Several explanations are possible for the lack of increases in many preventive services; characteristics of the preventive care, the disease they target, the beneficiaries, the providers, and the insurance coverage may all create other barriers preventing the increase of the preventive care.

This paper contributes to four strands of literature. The first strand of literature studies the impact of removing cost-sharing for Medicare-covered preventive services on the use of preventive services. The findings are mixed. Goodwin and Anderson (2012) studies the Congress's elimination of Part B deductibles for the mammograms and pap smears in the 1990s using the 5% Medicare Beneficiary data, and found that the Medicare Part B deductible waivers are an effective strategy for increasing preventive service use. Jensen et al. (2015) and Chung et al. (2015) study the same federal benefit change as ours, but they compare the changes of preventive service utilization before and after the ACA's Medicare preventive benefits across insurance coverage groups, using and survey and administrative data only from California.

The second strand of literature uses the behavior responses to proxy the knowledge of the reform to identify the impact of social reforms. For example, Chetty et al. (2013) uses the extent to which self-employed individuals manipulate their incomes to benefit from the EITC to proxy the knowledge of the EITC benefits at the neighborhood level. Our paper is the first to use the differences in behavioral response across regions to characterize the impact of federal level changes on health care utilization.

The third strand of literature studies the geographic variation of the usage of health care services. For example, Gottlieb et al. (2010) argue that usage, not price differences, drives the regional variation in Medicare payment. Our paper argues that differences in knowledge about the prices of Medicare services across HRRs drive the variation in the usage of medical services.

The last strand of literature uses migration to isolate the neighborhood level influence from the individual preferences or tastes. For example, Finkelstein et al. (2014) exploit

Medicare patients migration and found that 40-50 percent of regional difference in health care utilization is due to the demand-side factors, rather than the place-specific supply factors. Molitor (2014) compared the practices of cardiologists who move between regions and find that environment factors are twice as important as physician-specific factors.

The rest of the paper proceeds as follows. Section 2 offers a theoretical framework. Section 3 outlines the empirical strategy. Section 4 describes the data. Section 5 discusses the proxy of the knowledge of the reform. Section 6 presents the main results. Section 7 discusses the findings.

2.2 THEORETICAL FRAMEWORK

We build upon the model of Chetty et al. (2013) and provide a framework for the analysis on the main impact of the MPB on the usage of preventive services, in the sample of beneficiaries who did not move during the years of study.

Individual i chooses whether to use a preventive service , s_i. Her utility is quasi-linear in income, C_i, or a numeraire consumption good, and the preventive service:

$$u(C_i, s_i, \alpha_i) = C_i + v(s_i, \alpha_i). \tag{2.1}$$

Here, α_i denotes an individual i's health or preference about preventive services. Assume α_i is an exogenous parameter. For example, the person's personal and family history is exogenously determined when she makes the choice of preventive service.

Let the price of the preventive service be $p \geq 0$. The price p affects the marginal incentive of individual i's usage of the service s_i.

Assume there are N cities indexed by $z = 1, \cdots, N$. People cannot move to a different city. Cities differ in their residents' knowledge about the reform of Medicare for exogenous reasons.

In city z, a fraction of λ_z of residents are aware of the changes of the price, thus for them, $p = 0$. The remainder of the residents are not aware of the benefits and still perceive a price of $p > 0$.

Cities may differ in the distribution of preference α_i, denoted by a smooth c.d.f. $G_z(\alpha_i)$, and in the fraction of compliers, i.e., the fraction of the people who switch to use the preventive service following the reform conditional on being aware of the reform, θ_z.

Denote the empirical distribution of the total usage of preventive service s in a city as $F(s)$. Let $F_z(s|p)$ denote the empirical distribution of the usage of preventive service in city z with a price p.

The objective is to characterize the impact of the MPB as it is currently perceived by individuals on the aggregate usage of preventive services:

$$\Delta F = F(s|p = 0) - F(s|p > 0). \tag{2.2}$$

The first term is the current (post 2011) distribution of the usage of preventive services under zero-costs of the service, and the second term is the potential distribution of the usage with costs of preventive services not waived.

We use the cities with no knowledge of the MPS ($\lambda_z = 0$) to identify this second term:

$$F(s|p > 0, \lambda_z = 0) = F(s|p = 0, \lambda_z = 0) \tag{2.3}$$

We measure λ_z as the fraction of individuals who following the MPB start to use a newly available service: annual wellness visit (AWV hereafter), ϕ_z. Note that because

$$\phi_z = \theta_z \lambda_z, \tag{2.4}$$

i.e., the percentage of AWV users equals the percentage of people who are aware of MPB (λ_z) times the probability that they would actually go and take the AWV conditional on knowing the reform (θ_z). Therefore, ϕ_z is only a proxy for the λ_z.

Assumption 1. *(Knowledge) Individuals in neighborhoods with no AWV users are not aware of the MPB:* $\phi_z = 0 \Rightarrow \lambda_z = 0$.

Under Assumption 1, the empirical distribution $F_z(s)$ in cities with no AWV users reveals the counterfactual distribution without the MPB. However, estimating treatment effect in (2.2) requires one to identify the mean usage of preventive services across all cities in the absence of MPB, $F(s|p > 0) = \frac{1}{N} F_z(s|p > 0)$. Thus we need two more assumptions.

Assumption 2. *(Cross-Sectional Identification) Individuals' health or preferences do not vary across cities with different levels of knowledge about the MPB:*

$$G(\alpha_i|\lambda_z) = G(\alpha_i), \forall \lambda_z.$$

Thus

$$\Delta(\hat{F}) = F(s|p) - F(s|p, \phi_z = 0)$$

Intuitively, the impact of MPB on the usage of preventive service could be identified by comparing the unconditional distribution of the usage with the distribution in cities without AWV users. This identification strategy requires that the usage or preventive services in cities without AWV users is representative of the distributions in other cities without the MPB. We could relax this assumption by using a panel data of the individuals and only require that the health or preferences of individuals in different cities do not trend differently around the MPB.

Assumption 3. *(Panel Identification) Changes in individuals' health or preferences following the MPB do not vary across cities with different levels of knowledge about the MPB:*

$$G_t(\alpha_i|\lambda_z) - G_{t-1}(\alpha_i|\lambda_z) = G_t(\alpha_i) - G_{t-1}(\alpha_i), \forall \lambda_z.$$

Now, we can identify $\Delta(F)$ using a difference-in-differences estimator that compares the usage of preventive service across cities before and after the MPB reform:

$$\Delta\hat{(F)}_{DD} = [F_t(s|p) - F_t(s|p, \phi_z = 0)] - [F_{t-1}(s|p) - F_{t-1}(s|p, \phi_z = 0)] \,.$$

The difference-in-differences estimator $\Delta\hat{(F)}_{DD}$ nets out the common factors that affect the usages of the preventive service across all cities.

2.3 DATA

We use 2008-2013 Medicare historical claims data from a 5% random sample of all Medicare beneficiaries from the Centers for Medicare & Medicaid Services. The data contains demographic information, 5-digit zip codes of the residence of the beneficiaries, and all details such as the medical procedures, diagnoses, payments, for each usage of healthcare.

Our study sample consists of all fee-for-service beneficiaries who were older than 65 in 2008 and alive as of December 31, 2013. For the main analysis, we use the sample of beneficiaries who lived in the same HRR during 2008-2013.[3] The usage of preventive services is determined by both the demand-side (for example health or preference of the individual) and the supply-side (for example the training of the physicians and the technology of the local hospitals) factors. For a non-mover, we assume that the supply-side factors (other than the price and information provided from the hospital regarding the colorectal screening service) are fixed, thus the majority of the unobserved characteristics of the local environment is fixed, allowing us to attribute the changes of the switching behavior to the

[3]The crosswalk between the 5-digit zip code each year and the HHR each year is downloaded from http://www.dartmouthatlas.org/tools/downloads.aspx?tab=39. Because the mapping between 5-digit zip codes and HRRs vary each year, the person might move between zip codes but stay in the same HRR. Because the same 5-digit zip code could be assigned to a different HRR region in different years, and there are around 890 3-digit Zip codes, and 306 HRR regions, mechanically, there would be more non-movers using the HRR definition than that using the 3-digit Zip definitions. The results using the 3-digit zip codes as the geographic units are highly similar, and are provided as robustness checks.

MPB.

Table B1 summarizes the demographic information of the beneficiaries in the non-movers' sample. On average, about 4,881 beneficiaries are observed in each HRR region; the average year of birth is 1933, or about 75 years old in 2008; about 62.6% are females and the majority are white (88.7%).[4]

2.4 PROXY FOR THE KNOWLEDGE OF THE REFORM

We use the take up rate of AWV as a proxy to measure the knowledge of the general new prevention benefits. During a wellness visit, a beneficiary can develop or update a personalized prevention plan based on his/her current health and risk factors. Specifically, this includes a health risk assessment, a review of medical and family history, some routine measurements, personalized health advice, a list of personalized risk factors and treatment options, and a screening schedule for appropriate preventive services. As a part of the new Medicare prevention benefit under the ACA, the annual wellness visit is offered for free every 12 months to all Medicare beneficiaries.

To exclude the effects of moving between HRRs on the definition of the take-up rate, the sample of beneficiaries includes only non-movers, or beneficiaries who lived in the same HRR during 2008-2013. Among the non-movers, we calculate the percentage of beneficiaries in each HRR that used the initial AWV visit in 2011. Figure B1 shows the histogram of the take-up rate. There is sufficiently large variation in the take-up rate across HRRs. The number of observations is 306. The mean is 7.3%; the standard deviation is 4.4%; the min

[4]The Medicare data exhibit inconsistencies between a patient's sex and any diagnosis or procedure on the patient's record. For example, a male patient with cervical cancer (diagnosis) or a female patient with a prostatectomy (procedure). In both instances, the indicated diagnosis or the procedure conflicts with the stated sex of the patient. Therefore, either the patient's diagnosis, procedure or sex is presumed to be incorrect. I do not adjust the sex using sex-specific ICD codes. This conflict is reflected in the main results where it is possible to see an increase in the usage of mammograms among males.

is 0.4% and the max is 24.3%.

Figure B2 shows the spatial variation in the λ across the 306 HRRs in the United States. The 306 HRRs are ranked in 10 deciles according to the percentage of beneficiaries using AWV initial service among the sample of non-movers. Each shade indicates a decile, and a darker shade means a higher knowledge of the reform. Inspecting the map, there is substantial dispersion in the usage of the AWV across HRRs. The HRRs with higher usages of AWV tend to be in the New England, the East North Central, Colorado, Arizona, and the northern part of the South Atlantic region.

We wish to investigate whether the knowledge of the reform is driven by the demand-side factors or the supply-side factors. We can exploit the effects of moving between HRRs of different knowledge about the reform on the change of the movers' knowledge, to see if the change can be explained by the origin or the destination HRR's knowledge.

We define a sample of movers, which includes beneficiaries living in the same HRR during the first two years post-reform, but moved to a different HRR during the third year post-reform. We use the first year post-reform to determine the origin HRR's ranking, and use the first and second year post-reform to make sure there is no pre-move sorting (as opposed to defining the movers' sample as the one who moved to a different HRR from 2011 in 2012 and then remain at the same HRR in 2013), but this leaves with only one year post-move, which is a limitation due to the data availability. Therefore, the beneficiary is a mover, if he/she lives in the same HRR in 2011 and 2012, but moves to a different HRR in 2013.

Table B2 summarizes the sample of movers. There are 15,225 beneficiaries in the sample of movers. There is a growing trend of the usage of the AWV: about 8.9% of beneficiaries used the AWV service in 2011, while the percentage increased to 11.4% in 2012 and 13.4% in 2013. The variable ΔUse_i is defined as the dummy "AWV use in 2013" minus the dummy "AWV use in 2012". For example, if a beneficiary i used AWV in 2012, but did not use it in 2013, the "change of AWV use" would be -1.

The variable $\Delta Decile_i$ is defined as individual i's destination HRR's AWV usage rate decile (in 2013) minus i's origin HRR's AWV usage rate decile (in 2012). For example, if a beneficiary moved from an HRR ranked in the 5th decile of the AWV usage rate in 2012, to another HRR ranked in the 8th decile in 2013, the "change of ranking" would be 3; if the beneficiary moved between HRRs but remain in the same decile, the "change of ranking" would be 0.

We wish to know whether moving to different HRRs ranked by the take-up rates of AWV affects the usage of AWV. We estimate the following specification:

$$\begin{aligned} \Delta Use_i = \alpha + \beta \Delta Decile_i + \sum_{k=2}^{10} \gamma_k OriginDecile_{i,k} \\ + \sum_{k=2}^{9} \delta_k DestinationDecile_{i,k} + X_i + \epsilon_i, \end{aligned} \tag{2.5}$$

where $\Delta Decile_i$ denotes the "change of decile". The variable $OriginDecile_i$ denotes the origin fixed effects, and the variable $DestinationDecile_i$ denotes the destination fixed effects (note that the omitted category is living in the first decile before move). Under the identifying assumption that the unobserved factor that determines the change of usage of preventive services is uncorrelated with the decision of moving ($\Delta Decile_i$), the parameter of interest, β, can be interpreted as the causal impact of moving to an area with more knowledge of the reform on the change of preventive care usages.

Alternatively, the outcomes can be $OriginUse_i$ (whether individual i used the service in year 2012) or $DestinationUse_i$ (whether individual i used the service in year 2013) to see if moving to an area with higher or lower knowledge of the reform explains the usage of the service at the origin and the destination HRRs, respectively.

The vector X_i denotes the vector of individual covariates, which includes gender, race categories (White, Black, Asian, Hispanics, North American natives, other races, and the omitted category is the unknown), and year-of-birth fixed effects. The equation is estimated using OLS, with robust standard errors.

Table B3 demonstrates the effects of moving to different HRRs on the take-up rates of the AWV service. The outcome variable for the first three columns is ΔUse_i. In the first column, we estimate equation (2.6) without the origin fixed effects, destination fixed effects and the individual covariates. Column 1 shows that if only regressing the change of usage on the change of decile, the estimated parameter of interest, β, is positive, but very small and insignificant, suggesting that moving to an HRR with higher usage of AWV is not associated with more usage of AWV.

However, after controlling for the origin fixed effects and the destination fixed effects, the estimate in column 2 becomes larger and statistically significant at 5% level. Furthermore, the parameters in front of the origin fixed effects are positive and statistically significant at 1% level: living in an HRR of a higher ranking before move is associated with a significant increase of the usage after the move. On the contrary, moving to an HRR with a higher ranking does not predict more usage of AWV after the move: only the parameter in front of the 8th decile in column 2 is statistically significant, and it is actually negative, suggesting that moving to the 8th decile actually is associated with less use of AWV after move.

What's most striking is the relative magnitudes of the γ_k's and β: the effects of the origin deciles are about 7 (= .0256/.0037) to 13 (=.0491/.0037) times as large as the effect of the $\Delta Decile_i$. Given that the mean of $\Delta Decile_i$ is .13 and the standard deviation 3.3, on average, the effects of the origin decile is much larger that of $\Delta Decile_i$.

Finally, adding the individual-level covariates X_i, the estimates in column 3 are very similar to those of column 2, suggesting that there is little bias from the selection on the observed individual characteristics, which is reassuring. Therefore, the estimates seems to suggest that it is the origin HRR's knowledge, rather than the destination HRR's knowledge, that affects the change of the AWV usage.

To have a better understanding of the explanatory power of $\Delta Decile_i$, the columns 4-6 replace the outcome variable with the dummy variable denoting AWV usage before move

($OriginUse_i$), and repeat the analyses in the first three columns. Column 4 shows that, if having no origin and destination decile fixed effects, moving to a new HRR with a higher knowledge is correlated with a reduction of usage. However, it is obvious that this is due to the omitted variable bias, and in column 5 β becomes positive and highly statistically, as expected. What's more, all estimates of the origin deciles (γ_k's) are positive and statistically significant at 1% level. Again, adding the individual covariates do not change the estimates (in column 6).

The dependent variable in columns 7-9 is the dummy variable denoting AWV usage after move ($DestinationUse_i$). The estimates show that the parameters for the origin deciles are very significant, while the parameters for the destination deciles are not. For example, column 9 suggests that, comparing to living in the 1st decile, living in the 5th decile before move is associated with a 11.7 percentage point higher probability of using AWV after move in 2013, while living in the 10th decile before move is associated with a striking 25.9 percentage point higher probability of using AWV after move.

To summarize, although moving to an HRR with a higher knowledge is indeed associated with a higher usage of AWV, the magnitude of the increase due to a larger knowledge difference between the destination and the origin HRR is very small, compared to the increase of usage associated with living in an HRR with a higher knowledge ranking before moving. The evidence seems to suggest that the factors determining the knowledge of the reform mainly come from the demand-side factors other than the observed demographic characteristics (age, race, and gender), such as preferences, tastes, and health, etc.

2.5 ECONOMETRIC FRAMEWORK

To estimate the effects of the MPB, which removes the copayment/coinsurance and deductibles for the preventive services that are recommended by the US Preventive Services

Task Force, the main specification uses a difference-in-differences framework:

$$Usage_{izt} = \alpha + \beta_1 Post_t + \beta_2 AWV_z \times Post_t + \theta_i + \theta_t + \epsilon_{izt}, \tag{2.6}$$

where the outcome variable is a dummy variable which equals 1 if the individual i in HRR z in year t uses one of the preventive services that are affected by the MPB, and 0 otherwise.[5][6] The outcome variables of interest include: AAA_{izt}, abdominal aortic aneurysm screening; Hbv_{izt}, Hepatitis B vaccination; Mnt_{izt}, nutrition therapy services (medical); Pap_{izt}, pap test; $Pelv_{izt}$, pelvic exams; $Mamm_{izt}$, screening mammogram; $Bnmss_{izt}$, Bone mass measurement (bone density); and a series of tests for colorectal cancer: $ClrctLowRisk_{izt}$, colonoscopy screening among beneficiaries with low risks of colorectal cancer, $ClrctHighRisk_{izt}$, colonoscopy among beneficiaries with high risks of colorectal cancer, Sig_{izt}, Colorectal cancer screening, flexible sigmoidoscopy, $FOBT_{izt}$, Colorectal cancer screening, fecal occult blood test, and $Blood_{izt}$, Colorectal cancer screening, blood, occult. There are two other screening tests for colorectal cancer screening, that are treated with a less intensity: the copayment/coinsurance applies, but the deductible is waived: $SigBarium_{izt}$, Colorectal cancer screening, screening sigmoidoscopy, Barium Enema, and $ColBarium_{izt}$, Colorectal cancer screening, screening colonoscopy, barium enema.

The $Post_t$ is a dummy variable which equals one for years 2011, 2012 and 2013. θ_i and θ_t are individual and year fixed effects, respectively. ϵ_{izt} is a random error term.

The parameter of interest is β_2, and under the identifying assumption that the unobserved factors that also affect the decision of preventive services usage at the individual level is orthogonal to the take up rate AWV_z, β_2 can be interpreted as the effect of the MPB on the usage of the outcome variable, per AWV rate. The key identifying assumption is: people in low-AWV-rate regions believe that the MPB does not affect their marginal

[5]The Medicare-covered preventive services can be found here: https://www.cms.gov/Medicare/Prevention/PrevntionGenInfo/Downloads/MPS-QuickReferenceChart-1TextOnly.pdf.

[6]The usages are extracted according to the HCPCS codes (HCPCS denotes the Healthcare Common Procedure Coding System, which is based on the American Medical Association's Current Procedural Terminology) shown in Appendix C.

incentive in determining whether to take preventive services.

Because some preventive services are not affected by the MPB, some already have no out-of-pocket costs before the MPB, the other still have out-of-pocket costs after the MPB, these services serve as the placebo outcome variables. The services that already have no out-of-pocket costs before the MPB include: Flu_{izt}, flu shots; and $Pneum_{izt}$, pneumonia shots; $ClrctDiagnostic_{izt}$, diagnostic colonoscopy (including screening with polyps detected ex post) and $Dbtsscrn_{izt}$, diabetes screening. The services which copayment/coinsurance and deductibles remain are: $Prstt_{izt}$, prostate cancer screening; $Card_{izt}$, cardiovascular disease screening tests; $Glucm_{izt}$, glaucoma; and $DbtsSlfMgmt_{izt}$, diabetes self management training.

Table B4 shows the summary statistics of the services that are affected by the MPB, in each year of 2008-2013, among the sample of the non-movers. Table B5 shows the summary statistics of the services that are affected by the MPB.

2.6 EMPIRICAL RESULTS

2.6.1 Motivating Figures

First, to provide some motivating graphs, we use the individual-month panel, to capture a more detailed capture of the trends of the usage. For the regression results, we still use the individual-year panel as specified in equation (2.6).

The next few figures show the de-trended usages of the preventive services that are affected by MPB, for beneficiaries living in the 1st (blue, dotted), 5th (dark green, dashed), and 10th (black, solid) decile of the AWV take-up rate, at each month from January 2008 to December 2013. The y-axis is the residual of a regression of the usage on the gender, race, birth year fixed effects, and monthly dummies, separately for the pre and post period. The x-axis denotes the number of months since January 1, 2011. The 95% confidence intervals are shown as well.

For example, Figure B3 shows the graph of the smoothed and de-trended usage of the abdominal aortic aneurysm screening, where before the reform, the usage of the beneficiaries living in the 1st, 5th, and 10 deciles of the knowledge index are flat and very similar; after the reform, however, the beneficiaries living in the 10th decile become much more likely to know about the removal of the out-of-pocket costs and increase the likelihood of using the service, while beneficiaries living in the 5th and the 1st deciles are less likely to know about the reform, and are relatively less likely to use the service. The fact that the three groups display flat and similar trends before the reform, and that the three groups display a diverging trend after the reform, is a visual demonstration that the effect of the MPB affects the usage of the abdominal aortic aneurysm screening, through the various degrees of knowledge of the reform. Similarly, Figure B3 to Figure B11 show the de-trended usages of the other preventive services by the knowledge deciles.

2.6.2 Main Results on the preventive services affected by MPB

Table B6 shows the effects of removing patient costs on the usage of impacted preventive services. The first column shows the simple comparison of the usages before and after the reform (pre- and post-2011). The second column is the estimate of the main specification (2.6), and the estimate of the interaction term $Post_t \times Knowledge_z$ is the parameter of interest. It can be interpreted as the causal effects of removing patient costs on the usage, given a knowledge rate of 100%. The third and fourth column estimates the main specification for males and females, respectively.[7]

For AAA screening, column 1 is significant, suggesting that the simple pre-and post-MPB comparison shows an increase in the usage of AAA screening. The column 2 is

[7]Note that there exists conflict situations where the males may perform female-specific procedures, such as mammograms, and vice versa. Though

positive and statistically significant at 1% level. Given that the mean of the $Knowledge_z$ is 7.26%, and the average usage of AAA is .0066 during 2008-2011, for an HRR with a typical knowledge of the reform, removing the patient costs on average increases the usage of AAA by about 78.7% (=$.726 * .00715/.0066$) from the pre-MPB level. The effects are driven by the males.

For bone mass measurement, the simple pre- and post-MPB comparison shows a decrease in the usage. The estimate on the interaction term $Post_t \times Knowledge_z$ is insignificant for the whole sample; interestingly, it is positive and statistically significant for the males, but negative and statistically significant for the females. To use the bone mass measurement service, the beneficiary should be at risk for osteoporosis and meet one or more conditions.[8] Therefore, the significant decrease for the females seems to suggest that, because individuals who are likely to use the AWV visit are likely to be healthier and have a lower risk for osteoporosis, the higher knowledge of the reform may associate with fewer females who are qualified for the bone mass measurement service.

For medical nutritional therapy, the interaction term $Post_t \times Knowledge_z$ is insignificant, though the simple pre- and post-MPB comparison shows an increase following the reform.[9]

For the hepatitis B vaccination, the effects are very small and not significant. The likely explanation seems to be the same as that for the bone mass measurement: the qualification criterion. Only the beneficiaries at high or medium risk for Hepatitis B are covered.[10]

Table B6 shows the effects on three preventive services that are used by females: screen-

[8] The conditions are: a woman whose doctor determines she's estrogen deficient and at risk for osteoporosis, based on her medical history and other findings; a person whose X-rays show possible osteoporosis, osteopenia, or vertebral fractures; a person taking prednisone or steroid-type drugs or is planning to begin this treatment; a person who has been diagnosed with primary hyperparathyroidism; and a person who is being monitored to see if their osteoporosis drug therapy is working.

[9] People with Part B who meet at least one of these conditions: Have diabetes; Have kidney disease Have had a kidney transplant in the last 36 months; People with Part B must get a referral from their doctor or qualified non-doctor practitioner for the service.

[10] The risk for Hepatitis B increases if having hemophilia, End-Stage Renal Disease, diabetes, or certain conditions that lower the resistance to infection.

ing mammography, pap tests, and pelvic tests. The estimate of $Post_t \times Knowledge_z$ is statistically significant only for screening mammography, and the usage of pap and pelvic tests actually decreased, though insignificantly. Given that the mean of screening mammography usage is .227 during 2008-2010, then on average, removing the patient costs increased the usage of screening mammography by about 0.6% (=.073 × .0186/.227). These results are similar to the findings in Goodwin and Anderson (2012), who found that the usage of mammograms increased following the waive of deductible and the usage of pap tests did not. The reason could be that the risk of developing breast cancer increases with age, whereas the risk of developing cervical cancer decreases with age. In addition, screening mammography are usually recommended for women aged 40 and over who are not in poor health, while cervical cancer screening can be discontinued in elderly women who have had two to three normal test results in a nine- or ten-year period. Furthermore, the change of guideline recommendations to less frequent screening and later starting age for cervical cancer and breast cancer around the same time period may have in part offset any impact of the ACA provision Han et al. (2015).

Table B6 also shows the effects on various tests for the screening of colorectal cancer. The MPB increased the usage of colonoscopy by beneficiaries with average risks of colorectal cancer, and the usage of FOBT test. Given that the average of the low risk usage is .00669 during 2008-2010, removing the patient prices increased the usage by about 6.6% (=.073 × .00606/.00669) on average. Given that the average of the FOBT usage is .0181 during 2008-2010, removing the patient prices increased the usage by about 18.2% (=.073×.0452/.0181) on average. The MPB did not affect the usage of colonoscopy by beneficiaries with high risks of colorectal cancer significantly; the comparison between the results for the average- and high-risk screening seem to confirm the assumption that people who are at high risks are not on the margin of the reform, i.e. they would use the service anyway and the out-of-pocket payments are less likely to be barrier of usage.

Table B7 shows the results for services not affected by MPB. Note that the usage of flu vaccination increased, the usage of diabetes self management training services decreased, and the usage of diagnostic colonoscopy changes decreased. For the flu vaccination, it is possible that learning about the reform and using the AWV services increased the awareness and likelihood of taking flu shots. For the diabetes screening test, it is possible that the For the diagnostic colonoscopy, it is possible that the physicians code the diagnostic colonoscopy as screening to help reduce the cost of the patients.

2.7 DISCUSSION

Though the MPB increased the usage of certain preventive services, such as the aaa screening, mammograms, colonoscopy by average-risk beneficiaries, and the FOBT for colorectal cancer, the usage for many other affected preventive services did not increase as expected. In addition to the qualification criterion, incidence and seriousness of the target disease, costs and other service-specific reasons, there are some broader reasons as well.

First, when the MPB reform took effect the vast majority of seniors already carried insurance beyond traditional Medicare that would have eliminated or greatly reduced any out-of-pocket copays they faced for these services (Han et al., 2015). Second, there exists a lack of appropriate counseling by physicians regarding the need for the usage of preventive services. The providers might not have the opportunity to evaluate and refer the beneficiaries for more preventive care. Third, there are other barriers to usage, such as presence of patient co-morbidities, poor functional status, physicians' focus on acute care issues, physicians' lack of time with patients, etc. Fourth, exactly because of the low take-up rate of the AWV service, the increase of the usage of many preventive services are slow. Previous research has shown that the low WMV take-up rate (on the same order of the AWV take-up rate) was insufficient to increase rates of cancer screening (Petroski and Regan, 2009). Finally, the data only includes 3 years after the reform, and the impacts may need longer time to show.

2.8 CONCLUSION

This paper studies the effects of the removal of out-of-pocket payments on the usage of the Medicare covered preventive services following the Affordable Care Act's Medicare Preventive Benefits. We find that usages of many preventive services increased, in regions with higher awareness of the reform, measured as a higher take-up rate of the "Annual Wellness Visits" service newly created by the reform. However, there are other barriers that prevent beneficiaries to fully utilize the preventive care, such as the lack of referral and counseling from the providers. In the future, one might wish to study the impact of the increasing usage of preventive services on the beneficiaries' health outcomes; a welfare analysis of the increasing usage of preventive services as a result of the removal of patient cost-sharing is also meaningful.

3.0 PHYSICIAN COUNSELING AND OBESITY: RD EVIDENCE FROM THE MEDICARE INTENSIVE BEHAVIORAL THERAPY PROGRAM

3.1 INTRODUCTION

Obesity is a leading health problem in the U.S. In 2009-2012, 69.1% of the population aged 20 years and older are overweight, i.e. with a body mass index (BMI) greater than or equal to 25 (kg/m2). Lifestyle management is critical in obesity management, where the advice and support from health care professional matters (Bardia et al., 2007). This paper asks the question: Does physician counseling reduce obesity?

The difficulty in answering this question is due to the omitted variable bias: the patients who seek advices and help from the physicians differ in their motivation, degrees of obesity and other perspectives from the patients who do not, which affect the outcome. One way to address this bias is to use randomized controlled trials, and previous studies have found that physician counseling increases the patients' adoption and duration of physical activity (Lewis et al., 1991; Pinto et al., 2008). However, the samples of observations are usually small (211 and 100 in the previous two studies, respectively) and the results speak to a specific group of patients in a specific local healthcare provider.

In this paper, we estimate the effect of physician counseling on obesity using a (fuzzy) regression discontinuity (RD) design. We exploit the policy change that Medicare started a new physician counseling program, the Intensive Behavioral Therapy (IBT) for Obesity, in late 2011 as part of the Affordable Care Act, for Medicare beneficiaries whose BMI is greater than or equal to 30. Beneficiaries with a BMI greater than or equal to 30 can choose whether or not to participate in the IBT, and the probability of participation is increasing in the BMI, allowing for a fuzzy RD design. Because the beneficiaries' observed and unobserved characteristics are likely to trend smoothly around the BMI-30 cutoff, the difference in the outcomes, such as the change of body weight within a year or the policy can be attributed to the IBT.

We use the 5% random sample of the Medicare historical claim data from the Centers for Medicare and Medicaid Services (CMS) to estimate the impact of IBT on obesity within the first two years of the implementation of the policy. Using the diagnosis codes, we came up with a sample of 13,113 beneficiaries, whose BMI range from 25.45 to 39.45. Although 62.9% of the beneficiaries were eligible for the service, less than 571 beneficiaries used the service. We find that the IBT program is not effective in reducing weights. The weight reduction observed for the obese beneficiaries is due to the selection bias, or other factors not related to the usage of IBT program. The likely reason is that beneficiaries are not using enough of the service: although they are entitled to receive up to 22 free counseling each year, the beneficiaries who ever used the IBT program only used it for about 4 times. The lack of interest from the beneficiaries and the physicians may explain.

This paper makes several contributions to the existing literature. First, we investigate the causal impact of physician counseling on obesity using administrative data that are nationally representative and with a much larger sample size those in the previous studies. Second, this is the first paper to evaluate the effectiveness of the IBT, which has important policy implications. Because the IBT is required to be provided by the primary care physicians or other primary care practitioners, the opportunity costs of the service are potentially much higher than the monetary costs (the IBT counseling is of zero-costs to the beneficiaries, and the Medicare pays about $26 per 30-minute physician counseling). The low usage rates have prompted the proposal from non-primary-care practitioners to broaden the scope of the program and allow it to be provided by practitioners like nutritionists and therapists as well. This paper would provide estimates for the arguments.

3.2 BACKGROUND

Effective for claims with dates of service November 29, 2011, and later, The CMS released a decision memo stating "the evidence is adequate to conclude that intensive behavioral therapy for obesity, defined as a body mass index (BMI)$\geq 30kg/m^2$, is reasonable and necessary for the prevention or early detection of illness or disability and is appropriate for individuals entitled to benefits under Part A or enrolled under Part B and is recommended with a grade of A or B by the U.S. Preventive Services Task Force (USPSTF)."

The IBT is available for Medicare beneficiaries with obesity, who are competent and alert at the time that counseling is provided and whose counseling is furnished by a qualified primary care physician or other primary care practitioner and in a primary care setting, CMS covers: a) One face-to-face visit every week for the first month; b) One face-to-face visit every other week for months 2-6; and c) One face-to-face visit every month for months 7-12, if the beneficiary meets the 3kg (6.6 lbs.) weight loss requirement as discussed below.[1] At the six month visit, a reassessment of obesity and a determination of the amount of weight loss must be performed. To be eligible for additional face-to-face visits occurring once a month for an additional six months, beneficiaries must have achieved a reduction in weight of at least 3kg (6.6 lbs.) over the course of the first six months of intensive therapy. This determination must be documented in the physician office records for applicable beneficiaries consistent with usual practice. For beneficiaries

[1] Effective July 2, 2012, for claims processed with dates of service on or after November 29, 2011, Medicare will pay for G0447 with appropriate ICD-9 code no more than 22 times in a 12-month period. We find that the largest number of the usage per beneficiary during November 29, 2011 and December 31, 2013 is 51. Some of the services have zero payments from Medicare (rejected), and it is possible to have more than one sessions on one day (longer than 30 minutes per visit, as each line denotes a 30-minute session).

who do not achieve a weight loss of at least 3kg (6.6 lbs.) during the first six months of intensive therapy, a reassessment of their readiness to change and BMI is appropriate after an additional six month period.[2]

The IBT consists of the following three components: a) Screening for obesity in adults using measurement of BMI calculated by dividing weight in kilograms by the square of height in meters (expressed in kg/m2); b) Dietary (nutritional) assessment; and c) Intensive behavioral counseling and behavioral therapy to promote sustained weight loss through high intensity interventions on diet and exercise.

The IBT should be consistent with the 5-A framework: a) Assess: Ask about/assess behavioral health risk(s) and factors affecting choice of behavior change goals/methods; b) Advise: Give clear, specific, and personalized behavior change advice, including information about personal health harms and benefits; c) Agree: Collaboratively select appropriate treatment goals and methods based on the patient's interest in and willingness to change the behavior; d) Assist: Using behavior change techniques (self-help and/or counseling), aid the patient in achieving agreed-upon goals by acquiring the skills, confidence and social/environmental supports for behavior change, supplemented with adjunctive medical treatments when appropriate; and e) Arrange: Schedule follow-up contacts (in person or by telephone) to provide ongoing assistance/support and to adjust the treatment plan as needed, including referral to more intensive or specialized treatment.

Medicare covers IBT for obesity provided in a primary care setting. For the purpose of the IBT, a primary care setting is defined as one in which there is a provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing a sustained partnership with patients, and practicing in the context of family and community, such as an independent clinic, an outpatient hospital, a physician's office, or a state or local public health clinic.[3]

[2] https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNMattersArticles/downloads/MM7641.pdf

[3] The following are not considered primary care settings under this definition: Ambulatory surgical

The HCPCS code for the IBT for obesity is G0447 (Face-to-Face Behavioral Counseling for Obesity, 15 minutes), and G0447 must be billed along with one of the ICD-9 codes for BMI 30.0 and over (V85.30-V85.39, V85.41-V85.45).[4] The Medicare coinsurance and Part B deductible are waived for this service. The national average Medicare payment is $26.

3.3 ECONOMETRIC FRAMEWORK

We can first estimate the reduced-form results using the following specification:

$$Y_i = \alpha_0 + \rho Z_i + \beta_0 g\left(R_i\right) + \epsilon_{0i}. \tag{3.1}$$

Variable Y_i is the outcome variable, which is the ratio of the last observed BMI to the first observed BMI during November 29, 2011 and December 31, 2013, minus 1, or the percentage change of the body weight during the time period. The reason that the outcome variable is the percentage change instead of the simple difference between the two BMIs is that a simple difference would re-scale the change of body weight by the height of the beneficiary.[5] If using the simple difference, the weight change is deflated for the taller beneficiaries, but inflated for the shorter beneficiaries. Thus we use the percentage change of the body weight (the ratio of BMIs) during the sample period as the outcome variable.

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centers, Emergency departments, Hospices, Independent diagnostic testing facilities, Inpatient hospital settings, Inpatient rehabilitation facilities, and Skilled nursing facilities.

[4]The type of service (TOS) for G0447 is 1. ICD-10 codes will be Z68.30-Z68.39, Z68.41- Z68.45. Additional Services on Same Date of Service: Obesity counseling is not separately payable with another encounter/visit on the same day. For services that contain HCPCS code G0447 with another encounter/visit with the same date of service, the service line with HCPCS G0447 will be denied. This intensive behavioral therapy service is considered to be included in the payment/allowance of other encounter services provided on the same date of service. This does not apply for Initial Preventative Physical Examination (IPPE) claims, claims containing modifier 59, and 77X claims containing Diabetes Self-Management Training and Medical Nutrition Therapy services.

[5]BMI is defined as $weight/height^2$. The difference $= BMI_2 - BMI_1 = weight_2/height^2 - weight_1/height^2 = weightchange/height^2$. The percentage change $= BMI_2/BMI_1 - 1 = weight_2/weight_1 - 1$.

The running variable, R_i denotes the first observed BMI during November 29, 2011 and December 31, 2013. The variable Z_i is a dummy variable indicating whether the beneficiary is eligible for the IBT program after November 29, 2011, i.e., it is a step function of the running variable R_i:

$$Z_R = \begin{cases} 0, & \text{if } R < 30 \\ 1, & \text{if } R \geq 30. \end{cases} \tag{3.2}$$

A beneficiary with a BMI greater than or equal to 30 may or may not participate in the IBT, but a beneficiary with a BMI less than 30 cannot participate in the IBT program.[6]

Even though the probability that a beneficiary with a BMI greater than or equal to 30 participates in IBT is not 1, the probability is increasing in the BMI. Therefore, our RD strategy satisfies the monotonicity requirement, and is a fuzzy RD approach. Because the fuzzy RD is effectively an instrumental variable approach (Z_i as the instrumental variable), we can use the following 2SLS specifications to identify the causal effects of qualifying for the IBT on obesity. $g(\cdot)$ is a function of the running variable, and we include up to the third order polynomial of R_i. Alternatively, we can include the polynomials of the deviation of the running variable from 30, and the interaction terms of the polynomials and the Z_R. The results are similar and shown in the appendix.

The first-stage specification of the 2SLS model is

$$D_i = \alpha_1 + \phi Z_i + \beta_1 g(R_i) + \epsilon_{1i}, \tag{3.3}$$

The dependent variable, D_i, is the treatment status, which is a dummy variable indicating that the beneficiary used the IBT for at least once during November 29, 2011 and December 31, 2012. Because the patient can take multiple IBT sessions during the year, we can

[6] There are 45 people in the sample whose first observation is less than 30, but used the IBT service later on. This is not impossible as their weight became heavier later on and are eligible for the service. Because the fuzzy RD requires monotonicity in the probability of being treated and the qualification status, we drop these observations.

alternatively define the D_i as a continuous variable indicating the total count of the usages of the IBT during November 29, 2011 and December 31, 2013, or the intensity of the IBT treatment. The parameter ϕ captures the change in the probability of enrolling in the IBT program.

The second stage captures the causal effect of the IBT program on the reduction of obesity:

$$Y_i = \alpha_2 + \lambda \hat{D}_i + \beta_2 g\left(R_i\right) + \epsilon_{2i}, \tag{3.4}$$

The parameter λ is the causal effect of the IBT program, and the variable $\hat{D}_i$ is the first-stage fitted value produced by estimating equation (3.3).

3.4 DATA AND MOTIVATING GRAPHS

We use the 5% random sample of the CMS Medicare historical data in years 2011-2013. We look at the sample of beneficiaries with 24 consecutive months of Part A and Part B coverage, and 0 months of HMO coverage, during January 1, 2011 and December 31, 2013.

First, we extract the observations with ICD-9 codes of V85.25-V85.39, which denote the adult BMI between 25.0 and 39.9, from the carrier claim data. Because each ICD-9 code denotes a range of BMI, I calculate the average of the lower and upper bound as the corresponding BMI. For example, an ICD-9 code of V85.21 denotes BMI between 25.0-25.9, and we assign 25.45 as the corresponding BMI. The BMI information of the ICD-9 codes and the assigned BMI level is shown in Table 1.[7] Second, we extract the observations with HCPCS code of G0447 from the carrier line data, and merge with the

[7]The ICD-9 codes contain BMI information larger than 39.9 as well. For example, ICD-9 OF V85.41 denotes a BMI between 40.0-44.9. However, because the range of BMI is much larger, and the average of the lower and upper bound would be a much noisier proxy of the true BMI, we do not use these BMI codes in our analysis.

BMI information. Next, we keep the beneficiaries for whom we know their BMI at least twice during November 29, 2011 and December 31, 2013.

Table C1 provides the summary statistics. The sample includes 13,113 beneficiaries, whose BMI range from 25.45 to 39.45. About 62.9% of the beneficiaries have a BMI of greater than or equal to 30, or are eligible for the IBT. 312 beneficiaries received at least one IBT, and the largest number of IBT received is 15. The usage rate of IBT is very low, and nationally only about 5,000 beneficiaries used the program in 2013.[8]

Table C2 provides the summary statistics for the non-qualified (BMI<30) and the qualified sample (BMI≥30) separately. Among the beneficiaries with a BMI greater than or equal to 30, less than 9.8% of them use the IBT services. The users and non-users do no differ in their initial BMI (the first BMI during the sample period), the probability of being female, and their ages. The users are less likely to be white.

Why do beneficiaries' BMI information appear in the claims? Table C13 lists the top procedures (Line HCPCS Common Procedure Coding) taken in the claims where we identify ICD-9 codes of V85.25-V85.39. The top procedures taken are established office visits (11.79%), blood tests of various kinds, comprehensive metabolic panel, therapeutic exercises to develop strength and endurance, range of motion, and flexibility, glycosylated (A1c), flu shots, chest x-rays, new patient visits and ophthalmological services, etc.

What characterize the users of the IBT program? Table C14 provides the ICD-9 codes that account for 50% of all diagnoses appeared in the IBT users' claims in 2011-2013. The most often seen diagnosis is hypertension, and the second often is diabetes. The IBT

[8]Weight loss specialists place the blame for poor awareness of the new benefit on the federal government's decision to limit counseling to primary care offices. "The problem with using only primary care providers," says Bonnie Modugno, a registered dietician in Santa Monica, California, "is that they completely ruled out direct reimbursement for the population of providers who are uniquely qualified and experienced working with weight management. I think that was a big mistake." She was referring to registered dietitians like herself, as well as specialists such as endocrinologists, who might be managing a person's diabetes, and cardiologists, who monitor patients with heart disease. Both conditions can be caused by or made worse by excess weight.http://www.webmd.com/health-insurance/20150223/few-seniors-benefiting-from-medicare-obesity-counseling.

users are also associated with atrial fibrillation (an irregular, often rapid heart rate that commonly causes poor blood flow), high amounts of cholesterol and fat particles in the blood, and under-active thyroid. They often have Vitamin D and B-complex deficiency; pain in the neck, shoulder, chest, abdomen, low back (lumbago), joints and limbs. They feel malaise and fatigue easily. Many have chronic airway obstruction, and shortness of breath. Many have infection in the urinary tract, and fungal infection of nails (dermatophytosis). Many take routine medical exams; many have long-term (current) use of anticoagulants or other medications. Some have anemia. Many have congestive heart failure and chronic airway obstruction. They might have degeneration of lumbar or lumbosacral intervertebral disc, or lumbosacral neuritis. They might have edema, or an excess of watery fluid collecting in the cavities or tissues of the body. Many have difficulty in walking and abnormality of gait, myalgia and myositis myalgia. Some cough, or have dizziness and giddiness.

In sum, the beneficiaries in our sample appear to be overweight/obese with various types of co-morbidities.

Table C15 lists the specialty of the providers of the IBT services. Because the Medicare only pays for the service in a primary care setting, it is possible that the providers receive zero payments from Medicare if they are not recognized as primary care providers. Table C15 suggests that about 60% of IBT services are provided by physicians in the internal medicine department, and another 28.5% is provided by family doctors.

Table C16 lists the top 20 states where beneficiaries use the IBT programs. The usage of the IBT is pretty concentrated in a few states. For example, users in Florida accounts for 13.58% of all usages, and those in New York 11.19%. Together with California, Texas and New Jersey, the top five states account for about 50% of all usages, and the top 20 states about 90%.

Figure C1 motivates the reduced-form analysis. The x-axis is the BMI that determines the eligibility of the IBT (the first observed BMI since Nov 20, 2011). The y-axis is the mean percentage change of the body weight during November 29, 2011 and December

31, 2013, for each BMI rate. Figure C1 suggests that although having a higher BMI is associated with negative changes of body weight, being eligible for the IBT program is associated with a tiny increase of the percentage change body weight: the change from just to the left to the just to the right of the BMI=30 cutoff is positive.

One concern is that the sample of beneficiaries whose BMI is recorded might not be a random sample. For example, Bardia et al. (2007) found that older and male patients were significantly less likely to be diagnosed as having obesity, whereas those with a BMI greater than 35, diabetes mellitus and obstructive sleep apnea were significantly more likely to have the diagnosis made. Therefore, it is a concern that our sample is likely to oversample the young and females, as well as those with obesity-related illness. Figure C2 to Figure C4 show the average age, the percentage of beneficiaries that are female, and average number of co-morbidities the beneficiaries have, for each BMI category. One can see that beneficiaries with a higher BMI are younger, are of about the same number of co-morbidities, and are more likely to be females. We can control for these characteristics in our analysis, as well as race categories, and the dummy variables indicating ever and new diagnosis of all 27 chronic conditions.

Another concern is that the duration of the period for which we observe the BMIs are different for different individuals. Figure C5 draws the density graph of the number of weeks between the first and last BMI, or the duration for which the percentage change of BMI is defined. In our analysis, we can control for the fixed effects for the number of weeks elapsed between the two BMIs, thus this is not a concern.

3.5 MAIN RESULTS

Table C3 shows the main results. Column 1 shows the reduced form results from estimating equation (1). Being qualified for the program is associated with a weight gain of about

0.9%. Column 2 reports the naive OLS regression between the usage and the weight change. Similarly, using the IBT at least once is associated with about 0.9% of weight gain. Column 3 reports the IV results, using the qualification status to instrument the dummy variable indicating ever using the IBT. The first-stage t-statistics of the instrumental variable is reported as well. The first stage is strong, and the IV estimate is much larger than the OLS one, and is statistically significant at 5% level: using the IBT is associated with a 9% increase of BMI. Column 4 reports the IV results on the effects of the total number of IBT usages on BMI change, using the qualification dummy as the instrument. The estimate is positive and statistically significant at 5% level. Each IBT usage is associated with about 2.3% of weight gain. Given that on overage beneficiaries who ever used IBT used it for 4 times (mean is 3.99), the IBT usage is associated with a total of 10% (=4 $\times$ 2.5%) gain body weight, which is pretty similar to the estimate from column 3.

The next four columns repeat the analysis but with a series of control variables, such as gender, race categories, age fixed effects (to control for the unobserved factors affecting the weight changes for beneficiaries with different ages), HRR fixed effects (to control for the common factors that affect the weight changes of beneficiaries living in the same Hospital Referral Region), the total number of co-morbidities, and dummies variables indicating ever diagnoses of 27 types of chronic conditions and new diagnoses of these conditions. The estimate remains similar and statistically significant, which is reassuring that the covariates do not significantly change the results and the identified estimates indeed come from the variation between the outcome variable just to the left and just to the right of the cutoff point.

Why is the estimate using the IV approach much larger than the estimate using the OLS approach? The reason is that the IBT service is not effective in reducing weight for the beneficiaries whose BMI is just above the cut-off: their weight actually increases following the service. However, from the motivating graphs, we do see a decrease in the BMI among the beneficiaries whose initial BMI is much higher than 30: there weights reduce after the usage of the IBT service. However, because the identifying power of the IV approach, or the Regression Discontinuity approach, only comes from the variation among beneficiaries just below and just above the cutoff points, we cannot attribute the weight loss of the very obese beneficiaries to the IBT program. Therefore, although the conclusion is that the IBT service is not effective in reducing weight, we do observe a reduction of the weight among beneficiaries who are with a much higher BMI.

This intuition is demonstrated in the Table C4 and Table C5, which show the subsample results by gender, race and age groups. In Table C4, the IV estimates are only significant among the males and the whites. Because the beneficiaries with larger BMIs are less likely to be males and whites (Figure C4 and Table C2), it seems that part of the reduction of weights observed are due to selection bias: female beneficiaries and non-white beneficiaries are more likely to reduce weight.

Similarly, in Table C5, the IV estimates are only significant among the males and the whites. Because the beneficiaries with larger BMIs are less likely to be males and whites (Figure C2 and Table C2), it seems that part of the reduction of weights observed are due to selection bias: female beneficiaries and non-white beneficiaries are more likely to reduce weight.

3.6 ALTERNATIVE EXPLANATIONS

Because the IBT users might also take other procedures that might reduce or increase weight during the period, we look at four alternative services that the beneficiaries might take and see if the weight change could be explained by those services.

We look at the use of smoke counseling, psychological counseling, massage, and bariatric procedures. Table C6 to Table C11 estimate the effects using the baseline specifications (column 3 and 4 in Table C3) for the users and non-users of the above procedures separately, and for the beneficiaries who have used none of the alternative procedures.[9] All specifications have the covariates, HRR fixed effects, the co-morbidity index, the dummy variable indicating ever- and new-diagnosis of chronic conditions, and the number-of-weeks-elapsed fixed effects.

The take-away message is that IBT program is associated with weight gain among both the users and non-users of most of these procedures, except that among the users of psychological therapy, using IBT is associated with weight reduction, although the impact is not statistically significant, possibly due to the small sample size (the number of psychological therapy users is 272).

To sum, the alternative procedures do not seem to impact the conclusion that the IBT is not effective in reducing weight. Interestingly, if combined with the use of psychological therapy, the IBT seems to be effective in reducing obesity, although we need a larger sample for a more reliable estimate.

3.7 DISCUSSION

Why is there a lack of usage of the free services? The reason is that it is not free for the physicians: the payments physicians receive from providing IBT is not enough to compensate for the physicians' time. The IBT is only allowed to be provided by the primary care physicians, and is not allowed to be provided by nutritionists, physician assistants, or other therapists. The average hourly wage of a primary care physician in the U.S. in 2015 is $90. However, for each half-an-hour service of the IBT, the physicians only receive a reimbursement of $26, which is less than a third of the opportunity cost of their time.

[9]Note that in Table C10, we cannot do the analysis for the sample of users of the bariatric procedures, because only patients with a BMI greater than 30 are allowed to use take the procedure. We need beneficiaries with a BMI below 30 in the sample to conduct the IV estimation.

In addition, the previous literature has shown that primary care physicians have a tendency to discriminate against obese patients; there is obesity stigma in clinical care. For example, primary care physicians have less respect, are less patient in communication, are less likely to build rapport, and are less likely to offer more services, when facing obese patients. See literature review in Phelan et al. (2015). For example, Gudzune et al. (2014) found that weight loss discussions between patients and primary care physicians may lead to greater weight loss in relationships where patients do not perceive judgment about their weight.

There are a few concerns about the validity of the study. First, the sample for which we observe a BMI coding is not random for non-IBT users. However, as long as there exists no break in the trend of selection along BMIs—it is observationally difficult to tell whether the beneficiary has a BMI of 29 or 30 (6.6 pounds' difference) ex ante when the physicians ask the patients to weigh their body weight—the Regression Discontinuity method would take care of this issue, and we have internal validity.

Another concern might be the method of identifying BMI information using the claim-based procedure. There are three reasons why it is a valid approach. First, Lloyd et al. (2015) found that the claims-based diagnosis of obesity underestimates the true prevalence in the older Medicare population with a low sensitivity (18.4%); however, this method has a high specificity (97.3%) and is accurate when it is present. Therefore, in our sample, the BMIs provide relatively correct information about the beneficiaries' weight and height. Second, Lloyd et al. (2015) found that the use of the obesity ICD-9 code increased over the study period and was more prevalent in later years and that the use of obesity codes will most likely continue to increase, due to increased use of these codes by physicians associated with treatment for individuals with the most severe obesity (Kuhle et al., 2011), such as bariatric surgery or the IBT for obesity program. Because our sample period is 2011-2012, the sensitivity in our sample may be much higher. Third, Lloyd et al. (2015) found that combining a claims-based obesity diagnosis with co-morbidities improves obesity identification among older adults. We control for the number of co-morbidities in our regressions, thus again this is not an issue.

Finally, there might be concern that our sample is not a representative sample of the whole Medicare population. Breault et al. (2002) noted that obesity is not usually a billable diagnosis, so clinicians often do not list it or do so sporadically.[10] However, because we only have the "flow" data on obesity from the Medicare claims in 2011-2012, it is impossible to fully identify the "stock" of obese population.

3.8 CONCLUSION

This paper investigate the causal impact of physician counseling on obesity exploiting the eligibility criterion of the Medicare's Intensive Behavioral Therapy for Obesity program, using a fuzzy Regression Discontinuity design. We find that the IBT program is not effective in reducing weights. The weight reduction observed for the obese beneficiaries is due to the selection bias, or other factors not related to the usage of IBT program. The likely reason is the lack of interest from both the beneficiaries' and the physicians' perspectives.

This paper contributes to the policy debates that we should broaden the scope of the IBT program, and allow non-primary-care practitioners, such as the registered dietitians or other nutrition professionals, to provide the IBT service. In our sample, the nurse

[10] Breault et al. (2002) documented that despite the ease of determining BMI, surveys have indicated that only 38 to 66 percent of overweight or obese patients have received diagnoses of overweight or obesity, and less than half of obese patients report that their physicians have advised them to lose weight and/or provided specific information about how to lose weight. According to the most recent data from the U.S. National Ambulatory Medical Care Survey, almost 50 percent of clinic visits lack complete height and weight data needed to screen for obesity using BMI. Of those visits where BMI was determined to be $\geq$30 kg/m^2, 70 percent of patients were not given a diagnosis of obesity and 63 percent did not receive any counseling for weight reduction. Even among those who suffer from obesity-related co-morbidities, only 52 percent were screened for obesity, 34 percent were diagnosed with obesity, and 46 percent were counseled about their obesity. When overweight American adults were surveyed, only 24.4 percent of obese Americans were referred by their physician to a dietician or nutritionist and 11 percent were recommended to a formal diet program; less than 10 percent of those who were overweight were referred for these nutritional services.

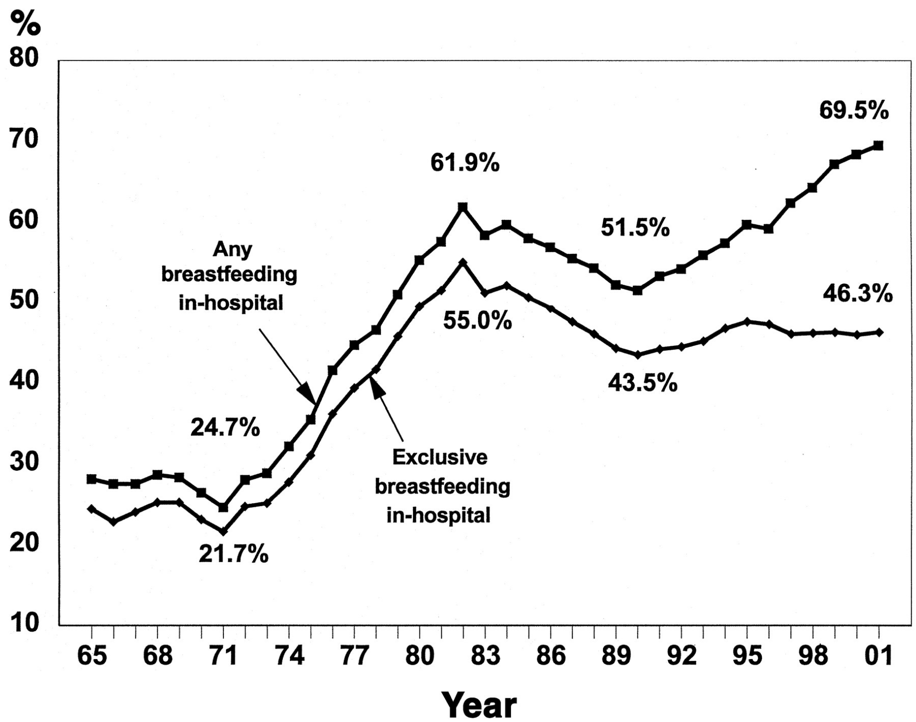
practitioners provided 4.64% of all IBT services, and the physician assistants provided 1.03%. If more eligible beneficiaries use the IBT service and use it for a longer period of time, we expect to see reduction of obesity and a more efficient use of the Medicare resources.

APPENDIX A

CHAPTER 1 APPENDIX

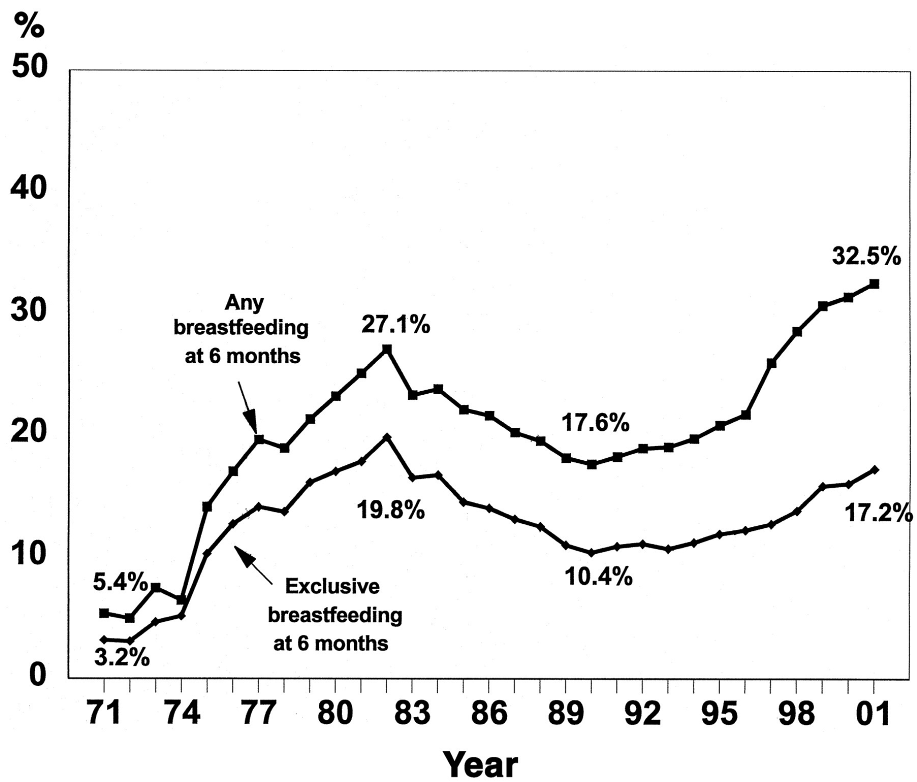
A.1 FIGURES

Figure A1: Trend of In-Hospital Breastfeeding Initiation Rates, 1965-2001



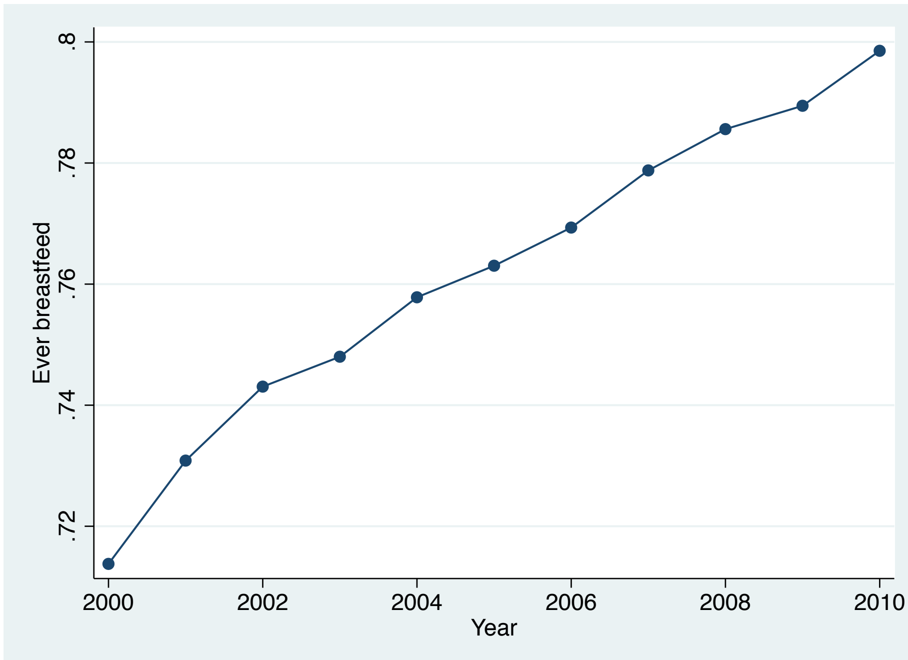
Source: Ryan et al. (2002)

Figure A2: Trend of The Percentage of Babies Breastfed at Month 6, 1971-2001



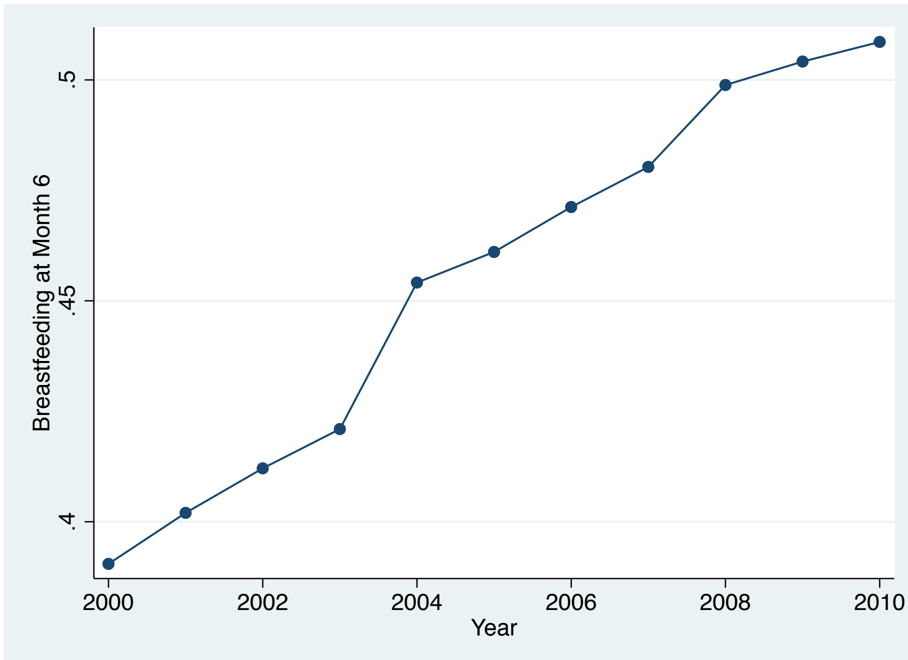
Source: Ryan et al. (2002)

Figure A3: Breastfeeding Initiation, 2000-2010



Source: Author's calculation using National Immunization Survey, 2003-2013.

Figure A4: Breastfeeding at Month 6, 2000-2010



Source: Author's calculation using National Immunization Survey, 2003-2013.

Figure A5: The Years of Passage of State Laws Regarding Workplace Breastfeeding Support

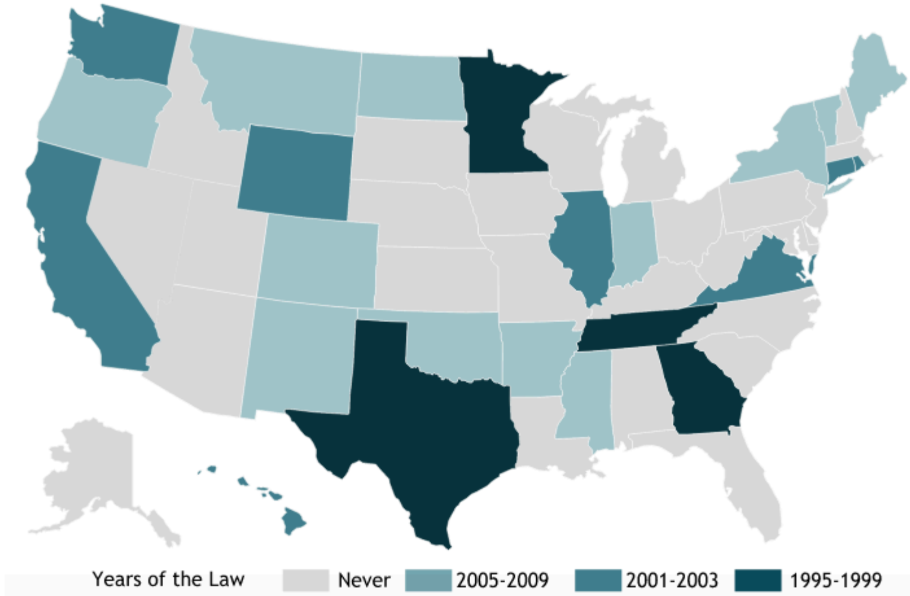


Figure A6: Theoretical Framework, Mandated Benefits in General

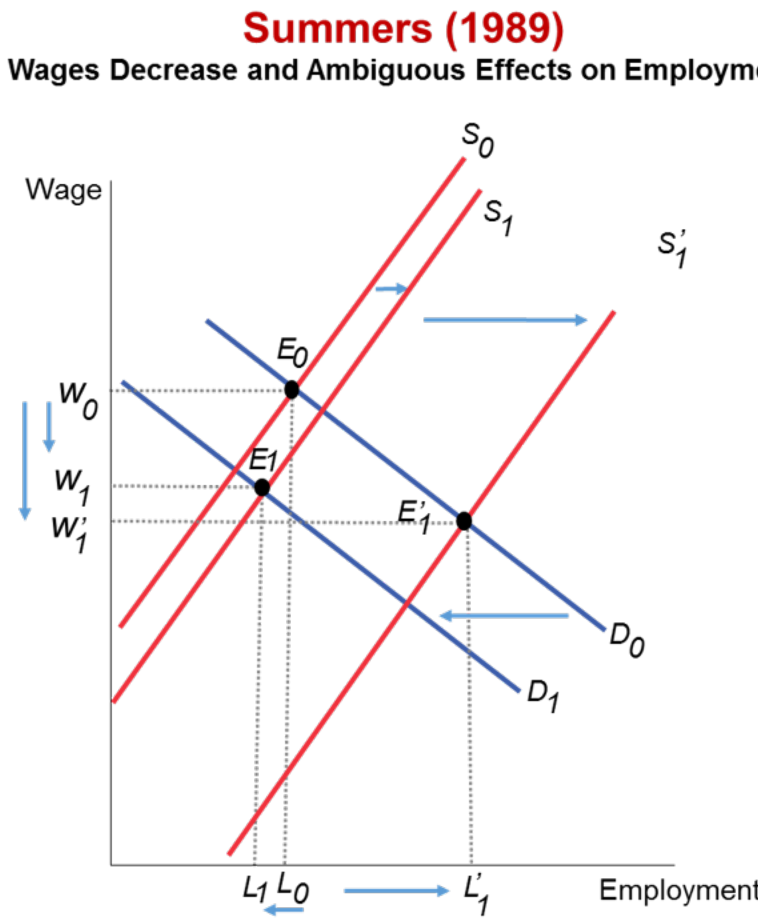


Figure A7: Theoretical Framework, Workplace Breastfeeding Benefits

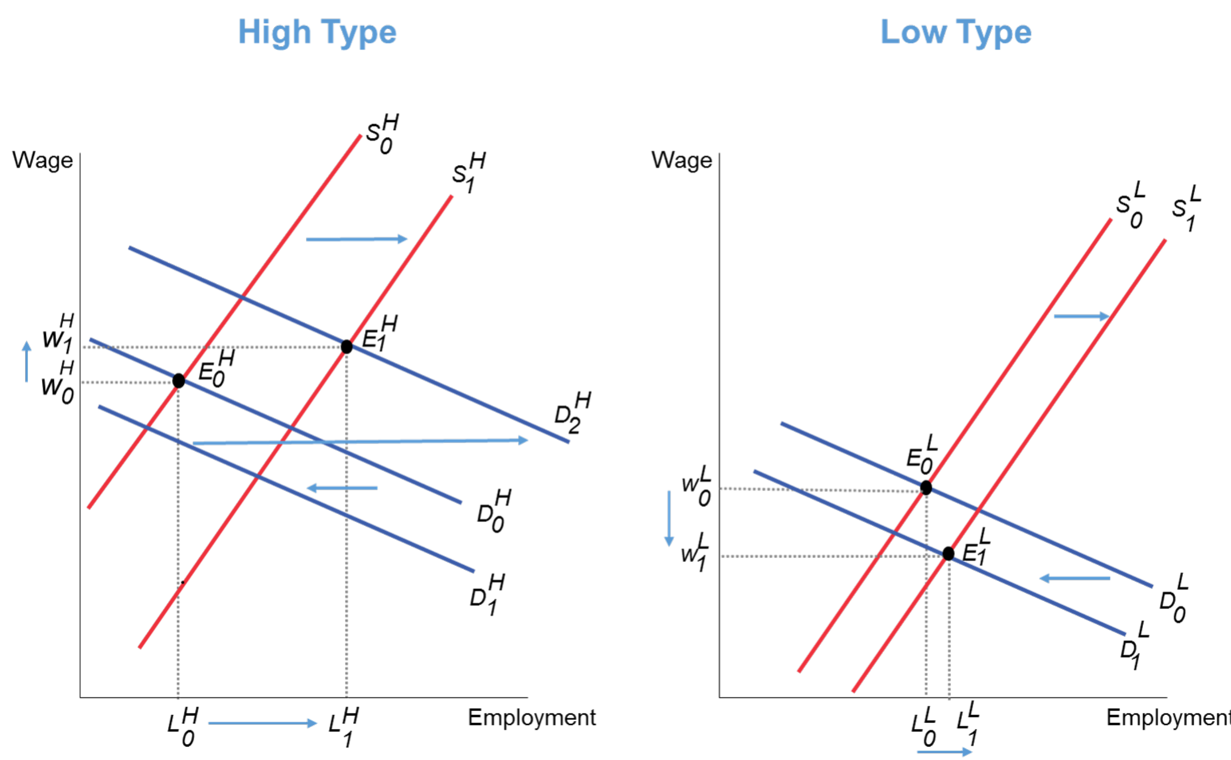
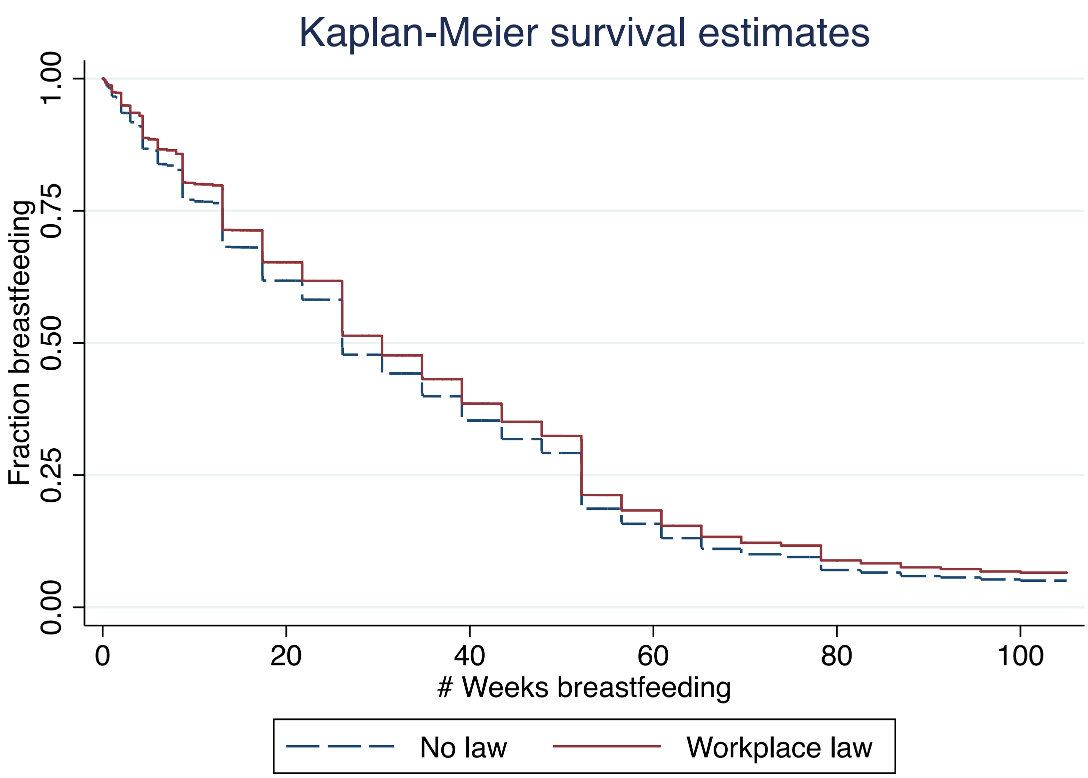
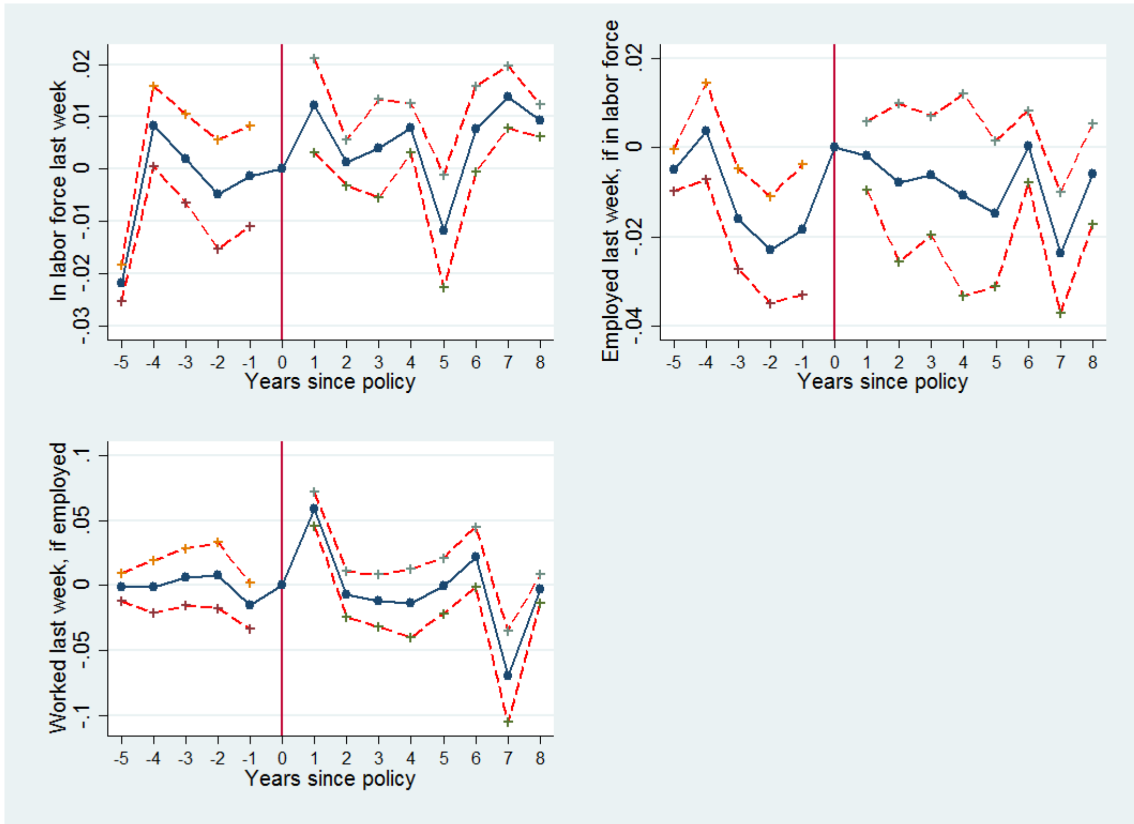


Figure A8: Effects of Workplace Breastfeeding Benefits Mandates on the Duration of Breastfeeding



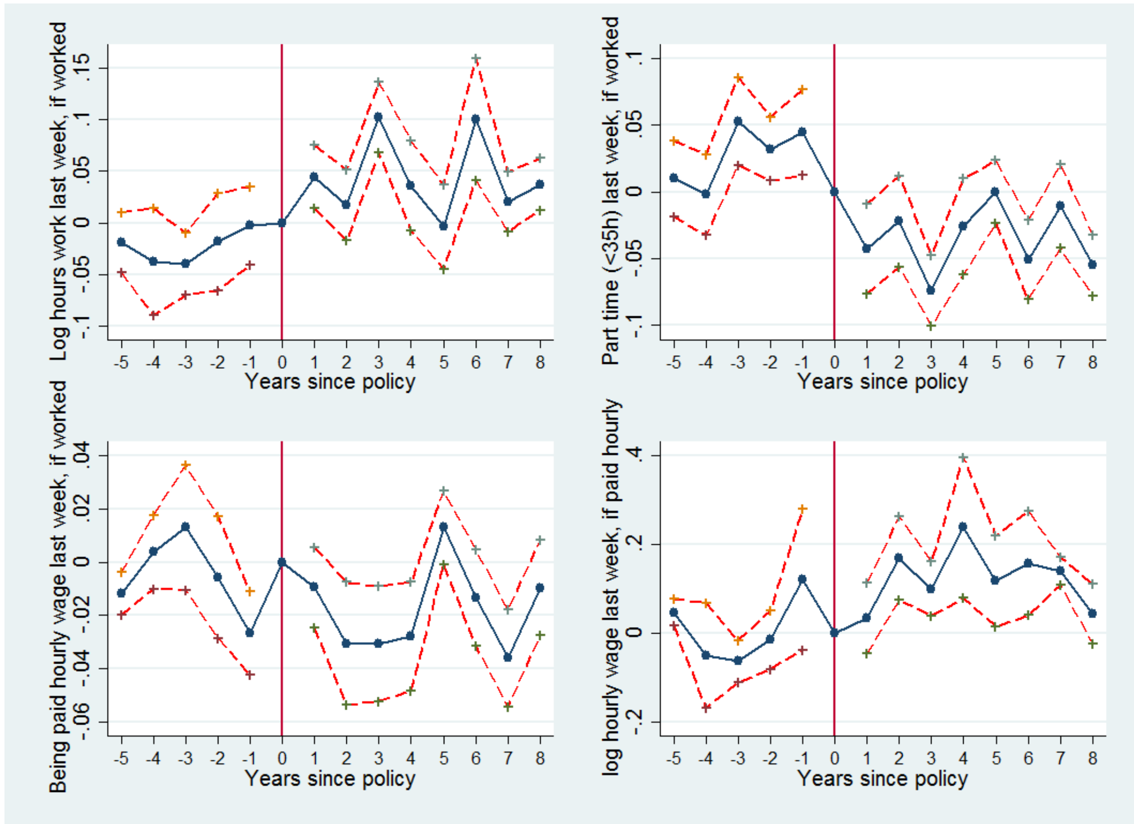
Notes: The figure shows the Kaplan-Meier survival curves for the number of weeks of breastfeeding with and without access to the workplace breastfeeding law. The y-axis is the fraction of babies who are still breastfed at each week after birth. The difference between the two groups is statistically significant at the 5% level.

Figure A9: Labor Market Effects of the Workplace Breastfeeding Benefits Mandates, Extensive Margins



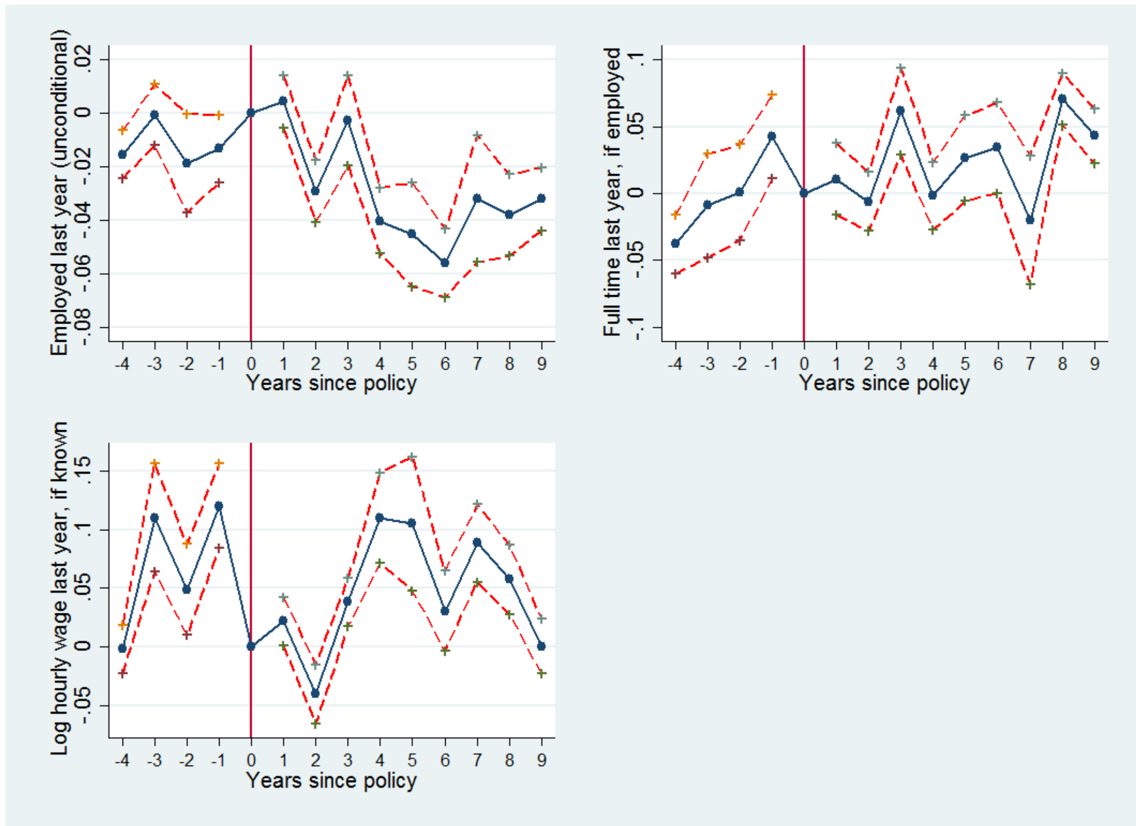
Notes: The y-axis plots the estimate and the 95% confidence intervals for the interaction term of the Women with infant children dummy and the dummy variable denoting k years post the enactment of the state level mandate. Note that $k = -5$ denotes that the year is 5 or more than 5 years before the state mandate, and $k = 8$ denotes the year is 8 or more than 8 years following mandate. The covariates include the state specific time trends.

Figure A10: Labor Market Effects of the Workplace Breastfeeding Benefits Mandates, Intensive Margins



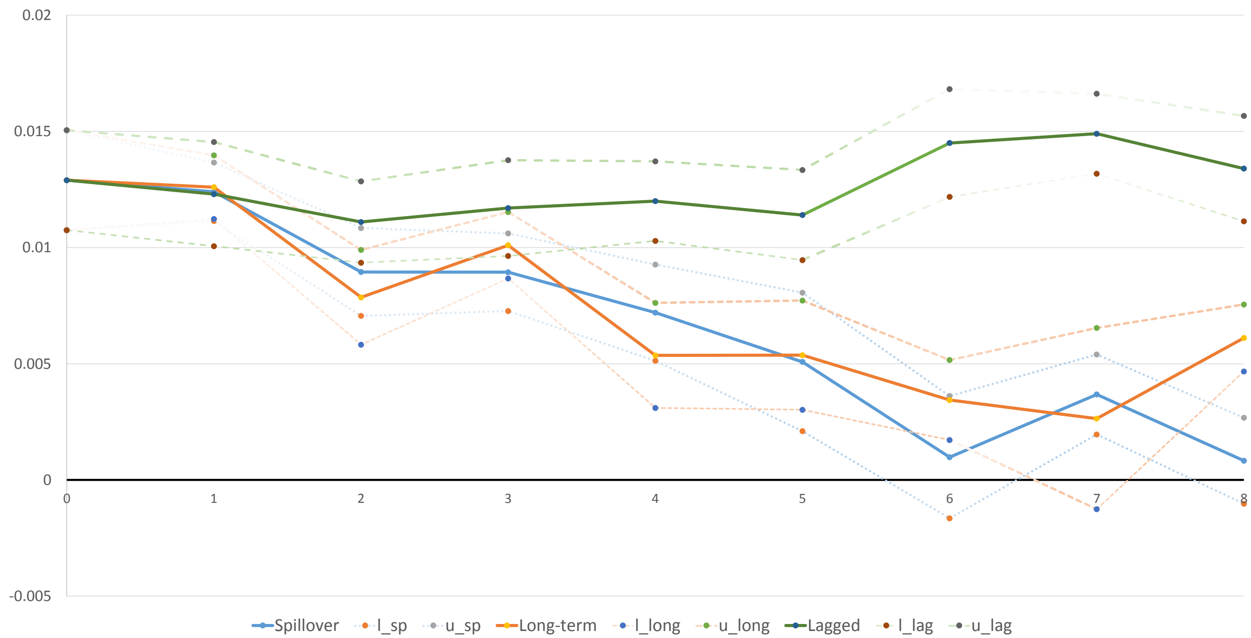
Notes: The y-axis plots the estimate and the 95% confidence intervals for the interaction term of the Women with infant children dummy and the dummy variable denoting k years post the enactment of the state level mandate. Note that $k = -5$ denotes that the year is 5 or more than 5 years before the state mandate, and $k = 8$ denotes the year is 8 or more than 8 years following mandate. The covariates include the state specific time trends.

Figure A11: Labor Market Effects of the Workplace Breastfeeding Benefits Mandates, Outcomes in the previous year



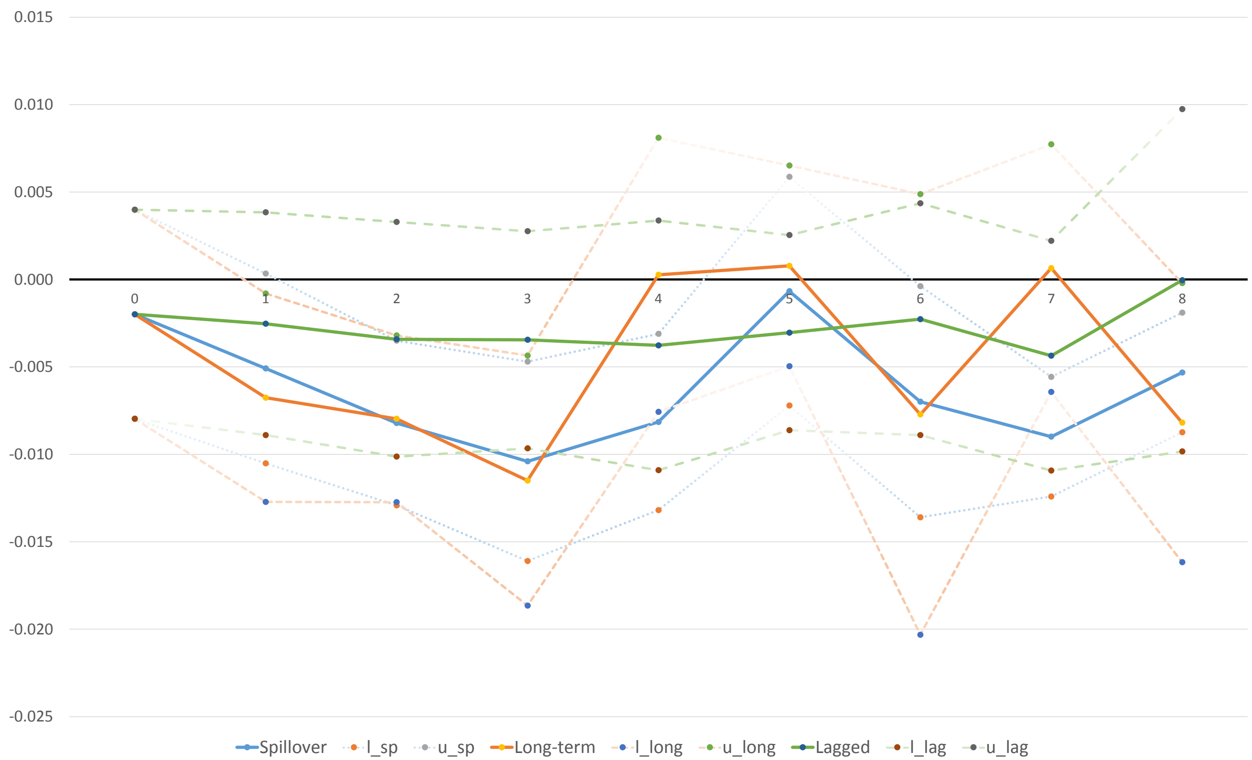
Notes: The y-axis plots the estimate and the 95% confidence intervals for the interaction term of the Women with infant children dummy and the dummy variable denoting k years post the enactment of the state level mandate. Note that $k = -5$ denotes that the year is 5 or more than 5 years before the state mandate, and $k = 8$ denotes the year is 8 or more than 8 years following mandate. The covariates include the state specific time trends.

Figure A12: Long-Term, Spill-Over, and Lagged Effects on Labor Force Participation



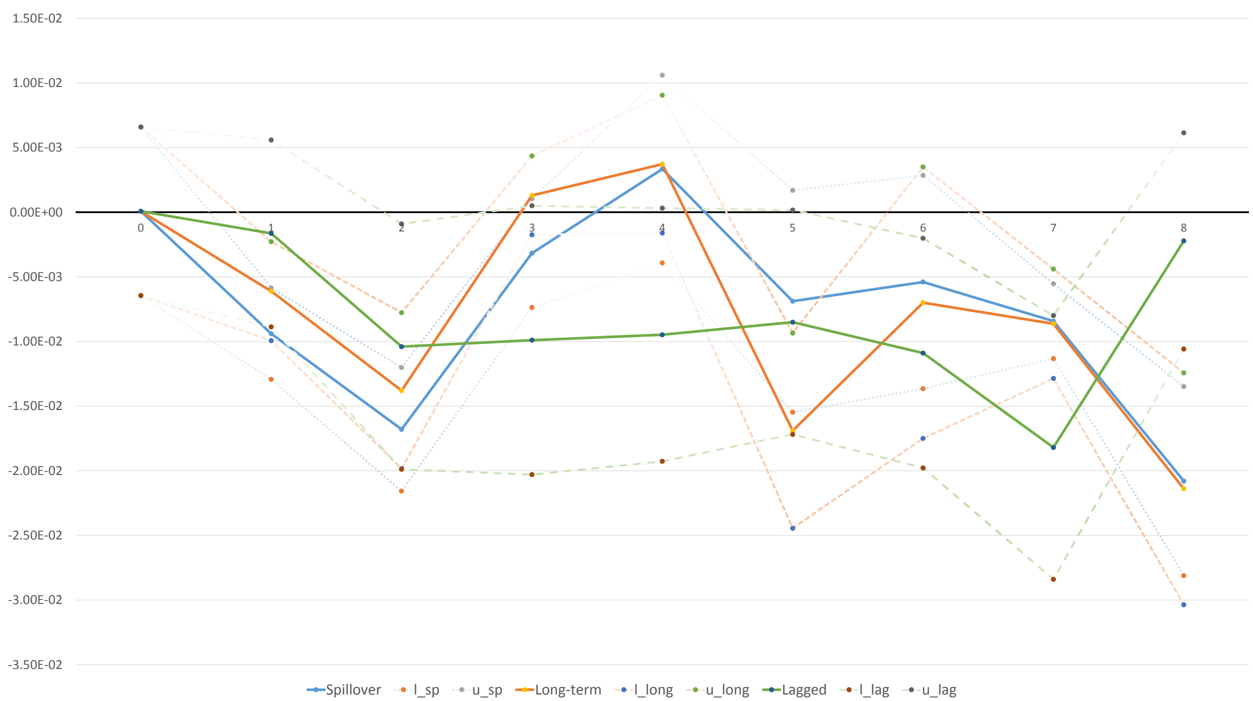
Notes: The figure shows the relative magnitudes of the long-term effects and the spill-over effects. For the long-term effects, the y axis denotes the estimates for $beta_3$ in equation (1.10) for $k \in \{0, 1, 2, \cdots, 7\}$. For the spill-over effects, the y axis denotes the estimates for $beta_3$ in equation (1.9) for $k \in \{0, 1, 2, \cdots, 7\}$. The x axis denotes k, $k \in \{0, 1, 2, \cdots, 7\}$. For the lagged effects, the y axis denotes the estimates for $beta_3$ in equation (1.8) for $k \in \{0, 1, 2, \cdots, 7\}$.

Figure A13: Long-Term, Spill-Over, and Lagged Effects on Probability of Being Employed



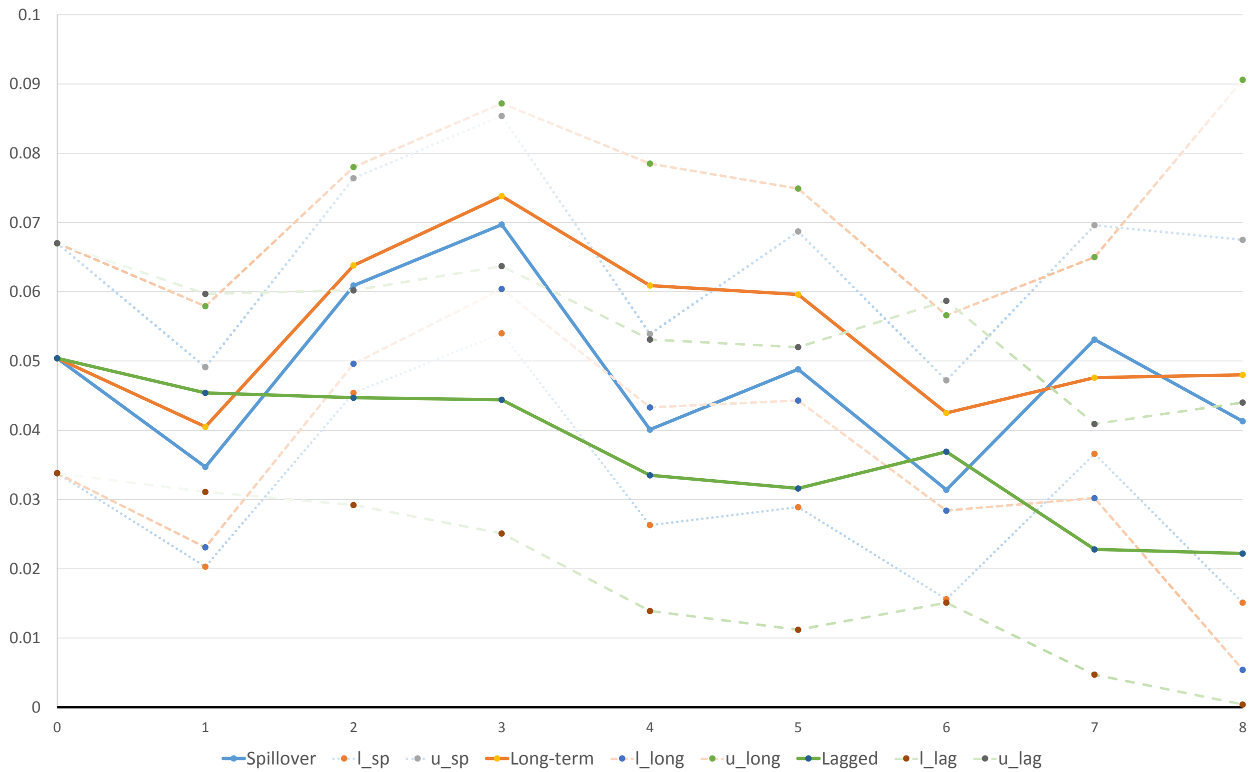
Notes: The figure shows the relative magnitudes of the long-term effects and the spill-over effects. For the long-term effects, the y axis denotes the estimates for $beta_3$ in equation (1.10) for $k \in \{0, 1, 2, \cdots, 7\}$. For the spill-over effects, the y axis denotes the estimates for $beta_3$ in equation (1.9) for $k \in \{0, 1, 2, \cdots, 7\}$. The x axis denotes k, $k \in \{0, 1, 2, \cdots, 7\}$. For the lagged effects, the y axis denotes the estimates for $beta_3$ in equation (1.8) for $k \in \{0, 1, 2, \cdots, 7\}$.

Figure A14: Long-Term, Spill-Over, and Lagged Effects on Probability of Working



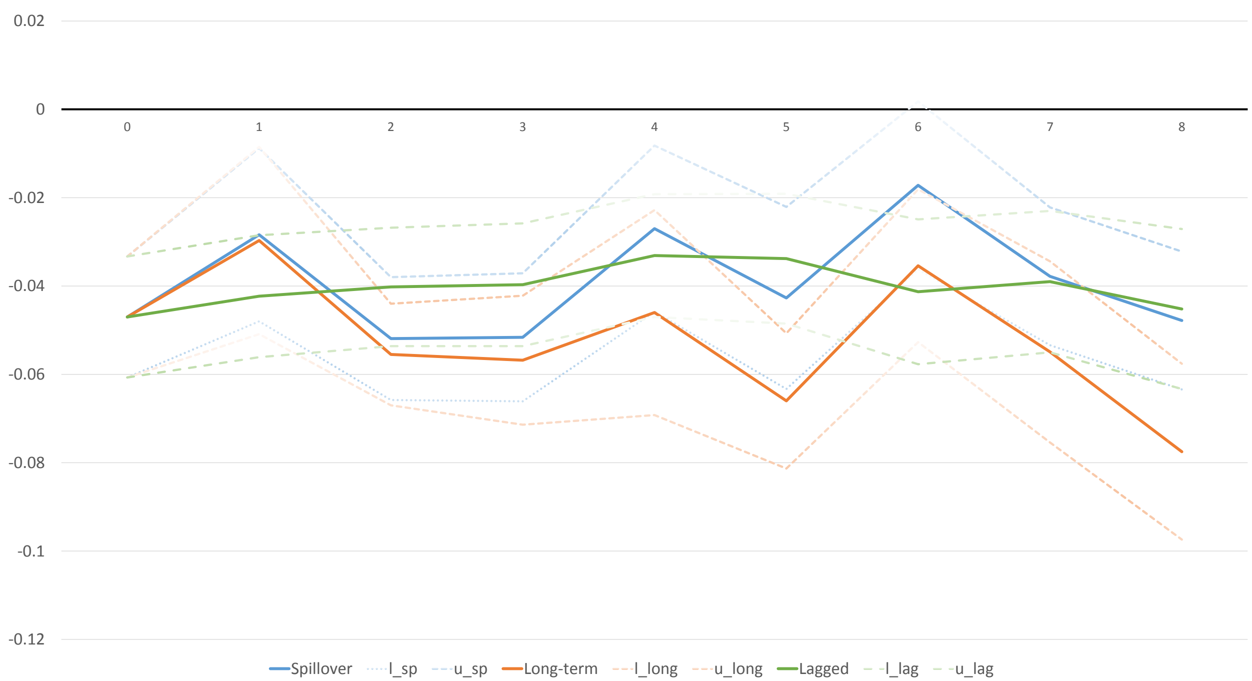
Notes: The figure shows the relative magnitudes of the long-term effects and the spill-over effects. For the long-term effects, the y axis denotes the estimates for $beta_3$ in equation (1.10) for $k \in \{0, 1, 2, \cdots, 7\}$. For the spill-over effects, the y axis denotes the estimates for $beta_3$ in equation (1.9) for $k \in \{0, 1, 2, \cdots, 7\}$. The x axis denotes k, $k \in \{0, 1, 2, \cdots, 7\}$. For the lagged effects, the y axis denotes the estimates for $beta_3$ in equation (1.8) for $k \in \{0, 1, 2, \cdots, 7\}$.

Figure A15: Long-Term, Spill-Over, and Lagged Effects on Hours of Work



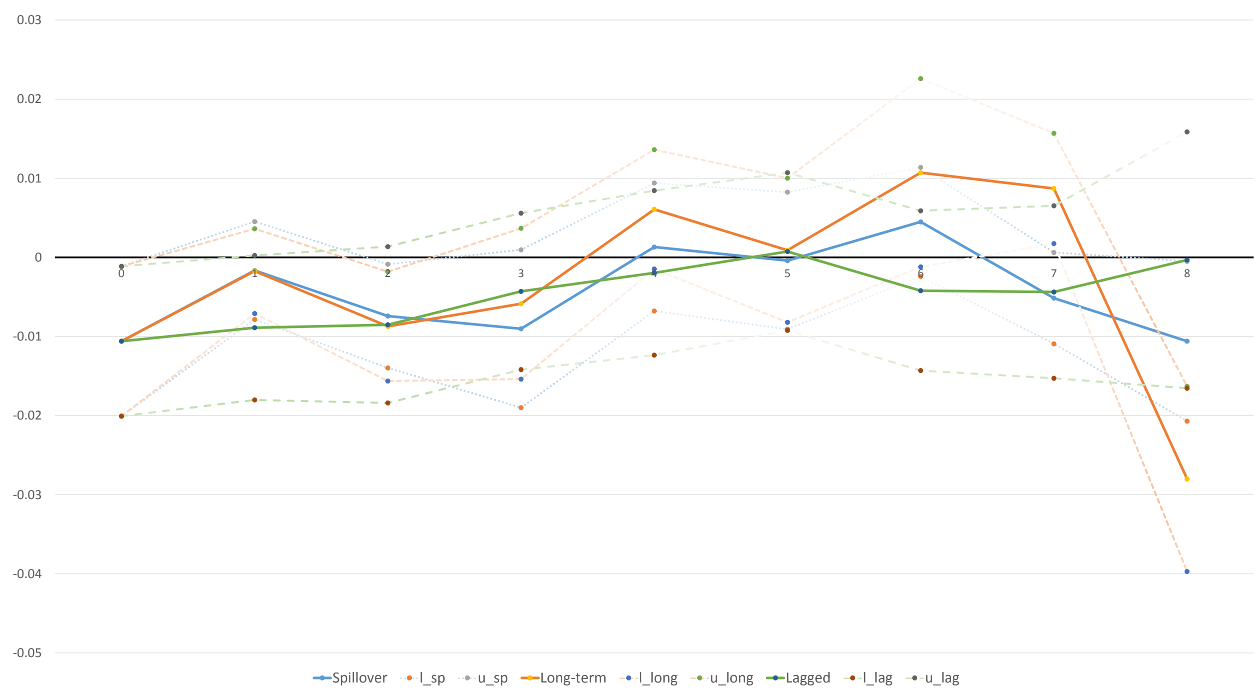
Notes: The figure shows the relative magnitudes of the long-term effects and the spill-over effects. For the long-term effects, the y axis denotes the estimates for $beta_3$ in equation (1.10) for $k \in \{0, 1, 2, \cdots, 7\}$. For the spill-over effects, the y axis denotes the estimates for $beta_3$ in equation (1.9) for $k \in \{0, 1, 2, \cdots, 7\}$. The x axis denotes k, $k \in \{0, 1, 2, \cdots, 7\}$. For the lagged effects, the y axis denotes the estimates for $beta_3$ in equation (1.8) for $k \in \{0, 1, 2, \cdots, 7\}$.

Figure A16: Long-Term, Spill-Over, and Lagged Effects on Probability of Working Part Time



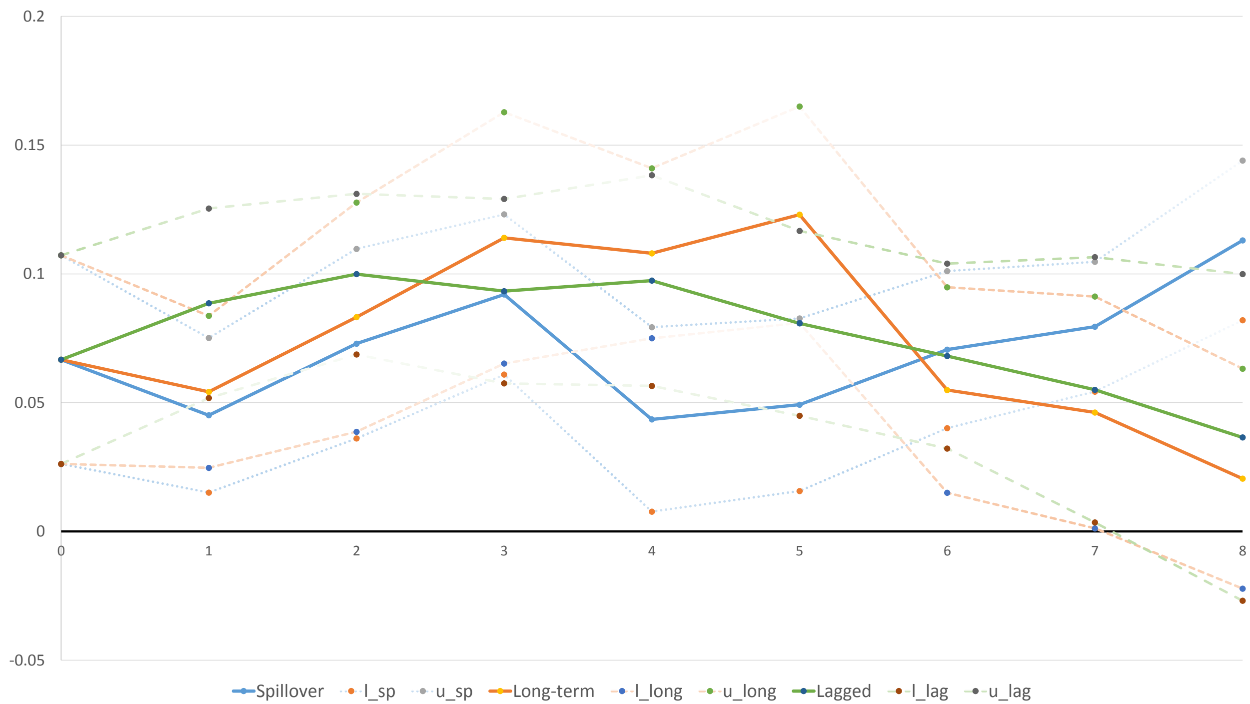
Notes: The figure shows the relative magnitudes of the long-term effects and the spill-over effects. For the long-term effects, the y axis denotes the estimates for $beta_3$ in equation (1.10) for $k \in \{0, 1, 2, \cdots, 7\}$. For the spill-over effects, the y axis denotes the estimates for $beta_3$ in equation (1.9) for $k \in \{0, 1, 2, \cdots, 7\}$. The x axis denotes k, $k \in \{0, 1, 2, \cdots, 7\}$. For the lagged effects, the y axis denotes the estimates for $beta_3$ in equation (1.8) for $k \in \{0, 1, 2, \cdots, 7\}$.

Figure A17: Long-Term, Spill-Over, and Lagged Effects on Probability of Being Paid Hourly



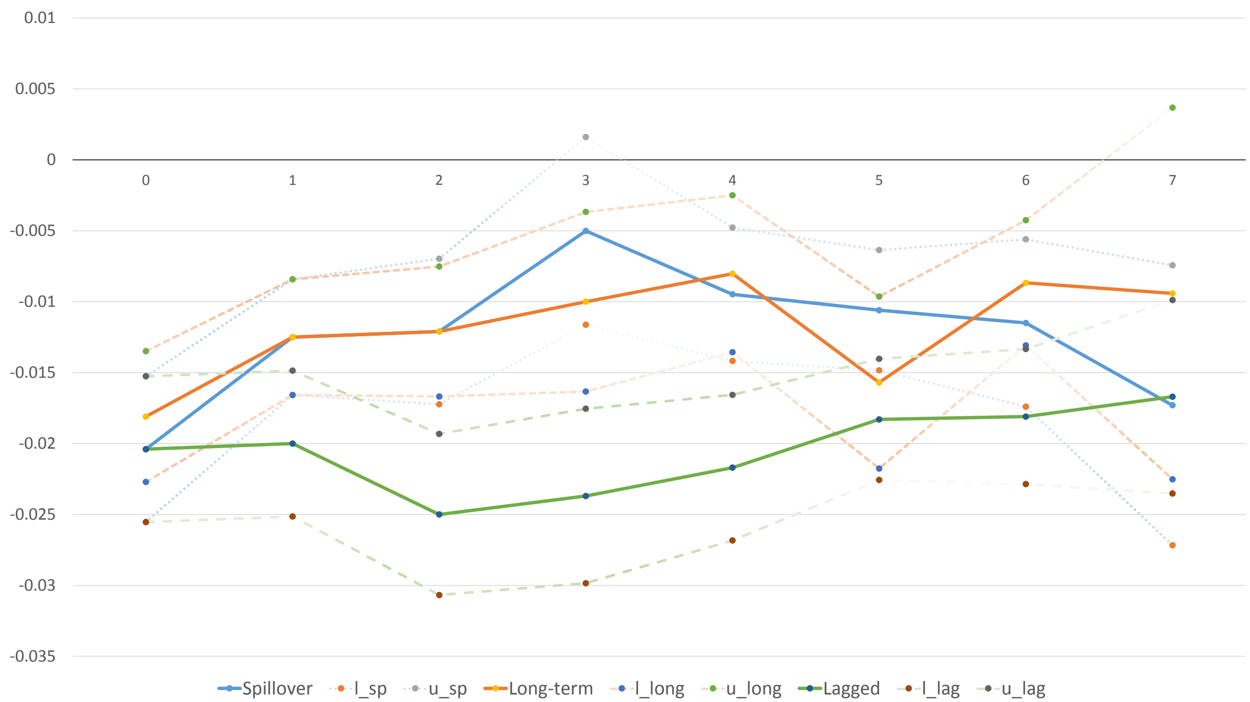
Notes: The figure shows the relative magnitudes of the long-term effects and the spill-over effects. For the long-term effects, the y axis denotes the estimates for $beta_3$ in equation (1.10) for $k \in \{0, 1, 2, \cdots, 7\}$. For the spill-over effects, the y axis denotes the estimates for $beta_3$ in equation (1.9) for $k \in \{0, 1, 2, \cdots, 7\}$. The x axis denotes k, $k \in \{0, 1, 2, \cdots, 7\}$. For the lagged effects, the y axis denotes the estimates for $beta_3$ in equation (1.8) for $k \in \{0, 1, 2, \cdots, 7\}$.

Figure A18: Long-Term, Spill-Over, and Lagged Effects on Hourly Wage (if Being Paid Hourly)



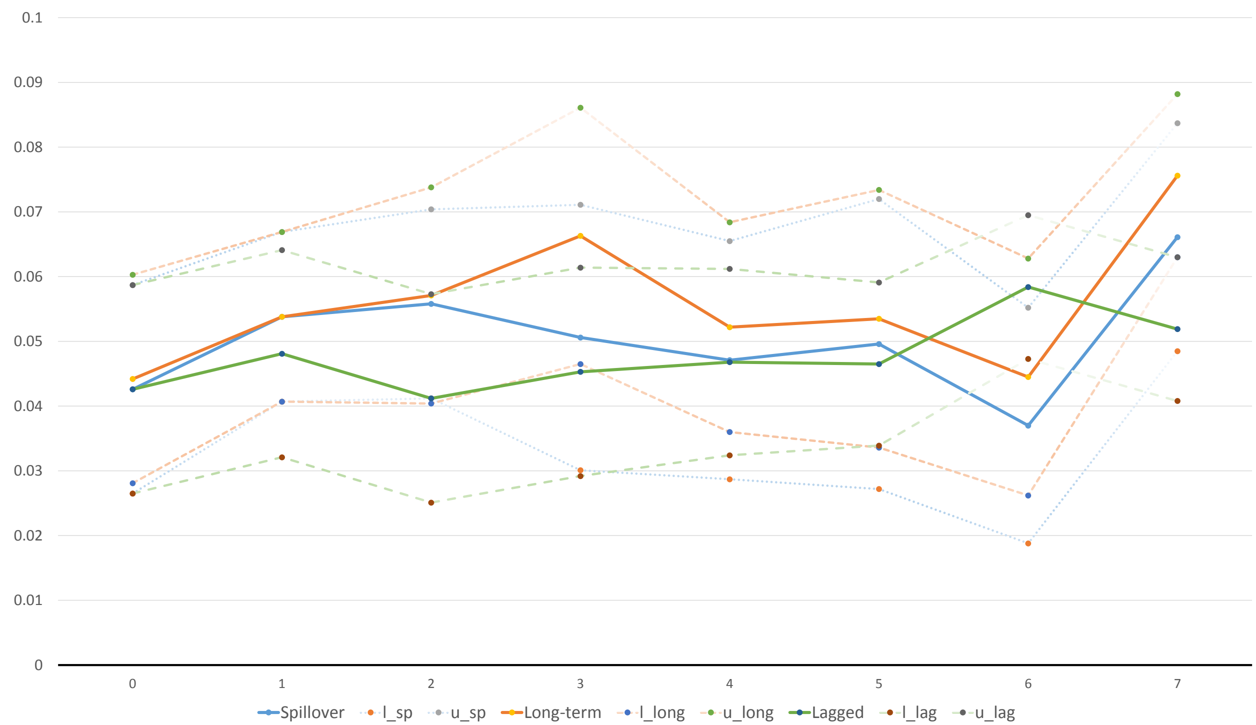
Notes: The figure shows the relative magnitudes of the long-term effects and the spill-over effects. For the long-term effects, the y axis denotes the estimates for $beta_3$ in equation (1.10) for $k \in \{0, 1, 2, \cdots, 7\}$. For the spill-over effects, the y axis denotes the estimates for $beta_3$ in equation (1.9) for $k \in \{0, 1, 2, \cdots, 7\}$. The x axis denotes k, $k \in \{0, 1, 2, \cdots, 7\}$. For the lagged effects, the y axis denotes the estimates for $beta_3$ in equation (1.8) for $k \in \{0, 1, 2, \cdots, 7\}$.

Figure A19: Long-Term, Spill-Over, and Lagged Effects on Employment Last Year (Unconditional)



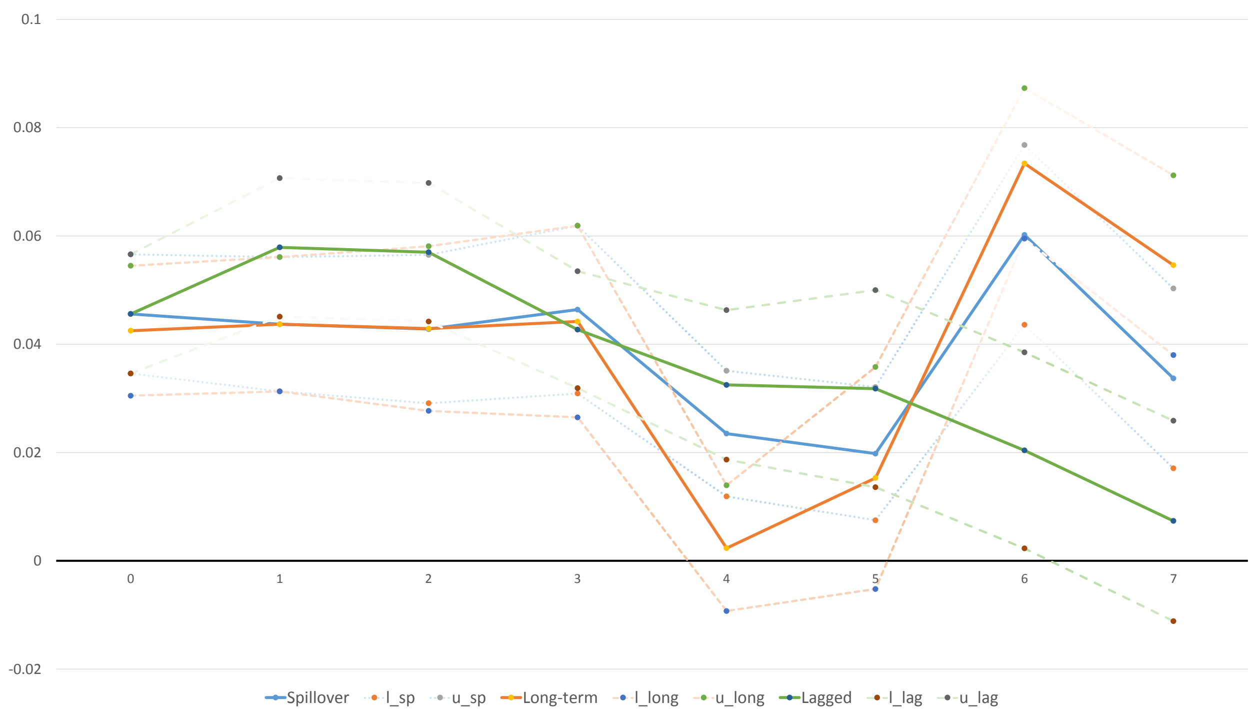
Notes: The figure shows the relative magnitudes of the long-term effects and the spill-over effects. For the long-term effects, the y axis denotes the estimates for $beta_3$ in equation (1.10) for $k \in \{0, 1, 2, \cdots, 7\}$. For the spill-over effects, the y axis denotes the estimates for $beta_3$ in equation (1.9) for $k \in \{0, 1, 2, \cdots, 7\}$. The x axis denotes k, $k \in \{0, 1, 2, \cdots, 7\}$. For the lagged effects, the y axis denotes the estimates for $beta_3$ in equation (1.8) for $k \in \{0, 1, 2, \cdots, 7\}$.

Figure A20: Long-Term, Spill-Over, and Lagged Effects on Probability of Being Employed Full Time



Notes: The figure shows the relative magnitudes of the long-term effects and the spill-over effects. For the long-term effects, the y axis denotes the estimates for $beta_3$ in equation (1.10) for $k \in \{0, 1, 2, \cdots, 7\}$. For the spill-over effects, the y axis denotes the estimates for $beta_3$ in equation (1.9) for $k \in \{0, 1, 2, \cdots, 7\}$. The x axis denotes k, $k \in \{0, 1, 2, \cdots, 7\}$. For the lagged effects, the y axis denotes the estimates for $beta_3$ in equation (1.8) for $k \in \{0, 1, 2, \cdots, 7\}$.

Figure A21: Long-Term, Spill-Over, and Lagged Effects on Hourly Wage Last Year



Notes: The figure shows the relative magnitudes of the long-term effects and the spill-over effects. For the long-term effects, the y axis denotes the estimates for $beta_3$ in equation (1.10) for $k \in \{0, 1, 2, \cdots, 7\}$. For the spill-over effects, the y axis denotes the estimates for $beta_3$ in equation (1.9) for $k \in \{0, 1, 2, \cdots, 7\}$. The x axis denotes k, $k \in \{0, 1, 2, \cdots, 7\}$. For the lagged effects, the y axis denotes the estimates for $beta_3$ in equation (1.8) for $k \in \{0, 1, 2, \cdots, 7\}$.

A.2 TABLES

Table A1: Mandates on Workplace Breastfeeding Support

State	Year	Words for break	Reasonable break time	Lengths	Words for space	Employer definition	Reasonable effort
Arkansas	2009	require	Y	not	require	N	Y
California	2001	shall	Y	Infant	shall	N	Y
Colorado	2008	shall	Y	2 years	shall	$\geq$1 employees	Y
Connecticut	2001	may	NOT	not	shall	$\geq$1 employees	Y
D.C.	2007	shall	Y	not	shall	N	Y
Georgia	1999	may	Y	infant	may	N	Y
Hawaii	1999[1]	shall	disallow employer to prohibit	during any meal period or other break	no	N	NO
Illinois	2001	shall	Y	infant	shall	>5 exclusive of the employer's immediate family	Y
Indiana	2008	shall	Y	infant	shall	state and public subdivisions of the state AND $\geq$25 employees	Y
Maine	2009	shall	Adequate	3 years	shall	N	Y
Minnesota	1998	must	Y	infant	must		
Mississippi	2006	no employer shall prohibit	during any meal period or other break	no			NO
Montana	2007	shall	Shall	not	must		NO
New Mexico	2007	shall	NOT	NOT	shall	an employer including state and its political subdivisions	NOT
New York	2007	shall	Y	3 years	shall		Y
North Dakota	2009[2]	designation					
Oklahoma	2006	may	Y	not	may		Y
Oregon	2007	shall	30 min during each 4 hour work period	18 months	shall		Y
Rhode Island	2003	may	Y	Infant	shall		Y
Tennessee	1999	shall	Y	Infant	shall		Y
Texas	1995[3]	designation					

Continued on Next Page...

Table A1 – Continued

State	Year	Words for break	Reasonable break time	Lengths	Words for space	Employer definition	Reasonable effort
Vermont	2008	shall	Y	3 years	shall		Y
Virginia	2002[4]	encourage	Y	Infant	encourage		Y
Washington	2001[5]	designation					
Wyoming	2003[6]	encourage	whenever flexible	infant	encourage		whenever feasible

Notes: The table, which lists the years different states passed the "Workplace law", summarizes state laws that require employers to provide unpaid break time and a special space for expressing breast milk. States that have passed state laws supporting breastfeeding at workplace are also included, such as Hawaii. The information is summarized on the website of National Conference of State Legislatures[7], Andrews (2012), and Abdulloeva and Eyler (2013). Y denotes yes, N denotes no.

[7] http://www.ncsl.org/research/health/breastfeeding-state-laws.aspx, accessed April 2015.

[2]Hawaii only "Disallows employers to prohibit an employee from expressing breastmilk during any meal period or other break period required by law to be provided by the employer or required by a collective bargaining agreement. (HB266 CD1)" http://www.capitol.hawaii.gov/session1999/status/hb266_his_.htm

[3]North Dakota only regulates the designation of "infant friendly" employers: An employer may use the designation "infant friendly" on its promotional materials if the employer adopts a workplace breastfeeding policy that includes the following: a. Flexible work scheduling, including scheduled breaks and permitting work patterns that provide time for the expression of breast milk; b. A convenient, sanitary, safe, and private location, other than a restroom, that allows privacy for breastfeeding or expressing breast milk; c. A convenient clean and safe water source with facilities for washing hands and rinsing breast-pumping equipment located in the private location specified in subdivision b; and d. A convenient hygienic refrigerator in the workplace for the temporary storage of the mother's breast milk.

[4]Texas only regulates businesses designated as "mother-friendly". Sec. 165.003. Business Designation as "Mother-Friendly". (a) A business may use the designation "mother-friendly" in its promotional materials if the business develops a policy that supports the practice of work-site breastfeeding by addressing the following: (1) work schedule flexibility, including scheduling breaks and work patterns to provide time for the expression of milk; (2) the provision of accessible locations that allow privacy; (3) access to a nearby clean and safe water source and a sink for washing hands and rinsing out any needed breast-pumping equipment; and (4) access to hygienic storage alternatives in the workplace for the mother's breast milk. (b) The business shall submit its breastfeeding policy to the department. The department shall maintain a list of "mother-friendly" businesses covered under this section and shall make the list available for public inspection. Added by Acts 1995, 74th Leg., ch. 600, Sec. 1, eff. Aug. 28, 1995. See http://www.statutes.legis.state.tx.us/Docs/HS/htm/HS.165.htm#165.003

[5]Virginia encourages employers to recognize the benefits of breastfeeding and to provide unpaid break time and appropriate space for employees who need to breastfeed or express milk for their infant children. http://leg1.state.va.us/cgi-bin/legp504.exe?021+sum+HJ145S

[6]Washington regulates "infant-friendly" employers: (1) An employer may use the designation "infant-friendly" on its promotional materials if the employer has an approved workplace breastfeeding policy that addresses at least the following: (a) Flexible work scheduling, including scheduled breaks and permitting work patterns that provide time for the expression of breast milk; (b) A convenient, sanitary, safe, and private location, other than a restroom, that provides privacy for breastfeeding or expressing breast milk; (c) A convenient clean and safe water source with facilities for washing hands and rinsing breast-pumping equipment that is located in the private location specified in (b) of this subsection; and (d) A convenient hygienic refrigerator in the workplace for the mother's breast milk. http://app.leg.wa.gov/RCW/default.aspx?cite=43.70.640

[7]Wyoming: "That the Legislature encourages breastfeeding and commends employers, both in the public and the private sector, who make accommodations for breastfeeding mothers whenever feasible." http://legisweb.state.wy.us/2003/enroll/hj0005.pdf

Table A2: 1990 State-level Prediction of the Passage of the Workplace Breastfeeding Support Laws

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Pct of pop living in central metro areas	Pct white	Pct in labor force	Pct employed	Mean wage income	Mean welfare income	Mean child welfare income	Mean firm size
Point Est.	1.485***	-0.835	-1.288	-1.913	2.39e-05	0.00240	-0.00385	-0.372
S.e	(0.547)	(0.683)	(2.325)	(2.343)	(4.07e-05)	(0.00198)	(0.00582)	(0.327)
R-squared	0.143	0.020	0.008	0.018	0.009	0.061	0.011	0.040
	Pct of women aged 15-21	Pct of women aged 22-30	Pct of women aged 31-44	Pct of women who are college grads	Pct of women aged 15-44 who are single	Labor force participation of women aged 15-44	Employment rate among women aged 15-44	Pct of women aged 15-44 that are mothers
Point Est.	9.510	3.490	7.608**	3.915	2.394	-1.458	-1.458	-0.00158
S.e	(8.461)	(5.390)	(3.517)	(2.607)	(2.586)	(1.884)	(1.884)	(3.818)
R-squared	0.043	0.012	0.068	0.069	0.025	0.017	0.017	0.000
	Ideology score of Rep party	Ideology score of Dem party	Ideology score of the governor	Ideology score of the state institution	Ideology score of all citizens			
Point Est.	0.00517	0.0168	0.00348	0.00473	0.00457			
S.e	(0.00888)	(0.0113)	(0.00390)	(0.00371)	(0.00563)			
R-squared	0.007	0.044	0.017	0.033	0.014			

Notes: The dependent variable is a dummy variable that equals 1 if the state ever passed the law by 2010, and 0 otherwise. Each estimate is the parameter of the variable of interest in a separate regression of the dependent variable on the state-level characteristics of interest. The number of observation is 51 in panel A and B, and 50 in panel C (D.C. is excluded). All regressions are weighted by the population weights. The F-statistics of the regression of the passage on all characteristics is 1.51. *** p<0.01, ** p<0.05, * p<0.1.
Source: 1990 Census. Berry et al. (1998).

Table A3: 1990 State-level Prediction of the Time Lag of the Passage of the Workplace Breastfeeding Support Laws

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Pct of pop living in central metro areas	Pct white	Pct in labor force	Pct employed	Mean wage income	Mean welfare income	Mean child welfare income	Mean firm size
Point Est.	7.506	-1.239	-14.69	-19.72	0.000157	0.0279*	0.0197	-3.432
S.e	(7.670)	(6.876)	(23.85)	(23.01)	(0.000370)	(0.0159)	(0.0484)	(2.828)
R-squared	0.040	0.000	0.011	0.020	0.004	0.091	0.003	0.037
	Pct of women aged 15-21	Pct of women aged 22-30	Pct of women aged 31-44	Pct of women who are college grads	Pct of women aged 15-44 who are single	Labor force participation of women aged 15-44	Employment rate among women aged 15-44	Pct of women aged 15-44 that are mothers
Point Est.	-22.23	2.892	36.49	37.90	19.41	-10.82	-10.82	2.268
S.e	(83.00)	(43.96)	(40.53)	(26.05)	(28.25)	(18.38)	(18.38)	(28.20)
R-squared	0.003	0.000	0.017	0.071	0.018	0.010	0.010	0.000
	Ideology score of Rep party	Ideology score of Dem party	Ideology score of the governor	Ideology score of the state institution	Ideology score of all citizens			
Point Est.	0.0867	0.151	0.0316	0.0146	0.0358			
S.e	(0.108)	(0.111)	(0.0438)	(0.0489)	(0.0572)			
R-squared	0.016	0.029	0.011	0.003	0.007			

Notes: The dependent variable equals the year of passage minus 1995, i.e. the lag from the first state that passed the law. Each estimate is the parameter of the variable of interest in a separate regression of the dependent variable on the state-level characteristics of interest. The number of observation is 51 in panel A and B, and 50 in panel C (D.C. is excluded). All regressions are weighted by the population weights. The F-statistics of the regression of the passage on all characteristics is 1.38. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.
Source: 1990 Census. Berry et al. (1998).

Table A4: Summary Statistics of the National Immunization Survey Sample

	(1)	(2)	(3)	(4)	(5)	(6)
	Control states		Treated states: before law		Treated states: after law	
VARIABLES	Mean	SD	Mean	SD	Mean	SD
Ever breastfeed	0.734	0.442	0.766	0.423	0.793	0.405
Male Child	0.513	0.500	0.513	0.500	0.511	0.500
Married	0.731	0.444	0.766	0.423	0.740	0.439
Hispanic	0.144	0.351	0.154	0.361	0.264	0.441
White	0.628	0.483	0.680	0.466	0.519	0.500
Black	0.142	0.349	0.0892	0.285	0.103	0.304
Other race	0.0860	0.280	0.0770	0.267	0.114	0.318
Non white	0.372	0.483	0.320	0.466	0.481	0.500
High School Dropouts	0.107	0.309	0.102	0.303	0.131	0.338
High School Graduates	0.222	0.416	0.237	0.425	0.199	0.399
Some College	0.238	0.426	0.226	0.418	0.232	0.422
College Graduates	0.433	0.495	0.435	0.496	0.438	0.496
First born	0.426	0.494	0.424	0.494	0.429	0.495
Number of children	1.888	0.614	1.888	0.620	1.887	0.612
Income poverty ratio (topcoded at 3)	1.939	1.104	1.918	1.076	1.886	1.127
Child Ever Received WIC	0.428	0.495	0.435	0.496	0.448	0.497
Child Receiving WIC	0.246	0.431	0.243	0.429	0.273	0.445
Mother Age$\leq$19	0.0201	0.140	0.0197	0.139	0.0204	0.141
Mother 19<Age< 30	0.361	0.480	0.396	0.489	0.337	0.473
Mother Age$\geq$30	0.619	0.486	0.585	0.493	0.643	0.479
Number of observations	115,522		25,923		111,689	

Table A5: Effects of Workplace Breastfeeding Benefits on Breastfeeding Outcomes

	(1)	(2)	(3)	(4)	(5)
	A: ever breastfeed				
Mean of dependent var	0.76				
Workplace Law	0.0121	0.0143	0.0115	0.0128	0.00579
	(0.0110)	(0.0108)	(0.0113)	(0.0113)	(0.00625)
One Year Before Law		-0.00704			
		(0.0107)			
Indecency Law			-0.00846		
			(0.0143)		
Jury Law			0.0191**		
			(0.00753)		
Any-place Law			-0.00580		
			(0.0103)		
Observations	253,134	253,134	253,134	253,134	253,134
R-squared	0.121	0.121	0.121	0.121	0.119
	B: log weeks of breastfeeding				
Mean of dependent var (censored)	3.01				
Workplace Law	0.0434**	0.0423*	0.0407**	0.0428**	0.0455*
	(0.0208)	(0.0233)	(0.0191)	(0.0186)	(0.0248)
One Year Before Law		0.00338			
		(0.0183)			
Indecency Law			0.0640		
			(0.0549)		
Jury Law			0.00768		
			(0.0532)		
Any-place Law			-0.0244		
			(0.0430)		
Observations	193,142	193,142	193,142	193,142	193,142
Statetrend	Y	Y	Y	Y	Y
Other Policies			Y		
Region by Year FE				Y	
Unweighted					Y

Notes: Standard errors in parentheses and are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1.

Table A6: Hazard Model Estimates of the Effects of Workplace Breastfeeding Benefits on the Duration of Breastfeeding

	(1)	(2)	(3)	(4)
VARIABLES	exponential	Weibull	Gompertz	Cox
Workplace law	-0.0359*	-0.0389**	-0.0387**	-0.0408**
	(0.0188)	(0.0188)	(0.0188)	(0.0188)
Observations	193,174	193,174	193,174	193,174

Notes: Standard errors in parentheses and are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1.

Table A7: Subsample Effects of Workplace Breastfeeding Benefits on the Initiation of Breastfeeding

ever bf VARIABLES	(1) high dropout	(2) high grad	(3) some college	(4) college +	(5) age≤19	(6) 19-30	(7) age≥30
Workplace law	0.0535	0.0268	-0.00926	-0.0121	0.126	0.0237*	0.00209
	(0.0322)	(0.0225)	(0.0104)	(0.0159)	(0.110)	(0.0140)	(0.0140)
Observations	29,666	53,997	59,307	110,164	5,109	89,603	158,422
R-squared	0.164	0.094	0.063	0.036	0.163	0.118	0.098

VARIABLES	married	single	White	Black	Hispanic	other race
Workplace law	-0.00578	0.0561***	0.00895	0.0269	0.0162	0.0217
	(0.0100)	(0.0204)	(0.0122)	(0.0222)	(0.0167)	(0.0208)
Observations	186,862	66,272	148,156	30,232	50,109	24,637
R-squared	0.069	0.111	0.129	0.150	0.036	0.138

VARIABLES	1st inc decile	2nd decile	3rd decile	4th decile	5th decile	top 50% inc dist	miss inc info
Workplace law	0.0361	0.0275	0.00575	-0.00398	0.0435	-0.0125	0.0372
	(0.0278)	(0.0281)	(0.0391)	(0.0244)	(0.0416)	(0.0177)	(0.0340)
Observations	22,899	22,916	22,892	22,912	22,941	114,406	24,168
R-squared	0.157	0.128	0.122	0.103	0.096	0.077	0.135

Notes: Standard errors in parentheses and are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1.

Table A8: Subsample Effects of Workplace Breastfeeding Benefits on the Duration of Breastfeeding

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	high dropout	high grad	some college	college +	age≤19	19-30	age≥30
Workplace law	0.206***	0.0885	-0.137***	0.0558	-0.188	0.136***	-0.00221
	(0.0748)	(0.0580)	(0.0493)	(0.0438)	(0.191)	(0.0421)	(0.0262)
Observations	18,765	34,419	44,951	95,007	2,704	63,147	127,291
VARIABLES	married	single	White	Black	Hispanic	other race	
Workplace law	0.0370*	0.0588	-0.00191	-0.129	0.223***	0.0381	
	(0.0190)	(0.0536)	(0.0355)	(0.164)	(0.0554)	(0.0541)	
Observations	153,164	39,978	117,447	17,040	39,621	19,034	
VARIABLES	1st inc decile	2nd decile	3rd decile	4th decile	5th decile	top 50% inc dist	miss inc info
Workplace law	0.163	0.00781	0.0586	0.0283	-0.108	0.0645**	0.00725
	(0.109)	(0.125)	(0.106)	(0.0607)	(0.0666)	(0.0298)	(0.0911)
Observations	13,582	15,445	16,208	16,814	17,690	95,407	17,996

Notes: Standard errors in parentheses and are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1.

Table A9: Summary Statistics of the Covariate Variables, the Current Population Survey, 1990-2010

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Treat: Females with infant children				Control: Males			
	Workplace law=0		Workplace law=1		Workplace law=0		Workplace law=1	
VARIABLES	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Individual covariates:								
Age	28.55	5.724	28.98	5.880	31.71	7.826	31.58	7.940
Married	0.817	0.386	0.792	0.406	0.607	0.488	0.576	0.494
Non white	0.166	0.372	0.202	0.401	0.151	0.358	0.214	0.410
High school dropout	0.205	0.404	0.179	0.383	0.202	0.401	0.188	0.391
High school graduates	0.264	0.441	0.260	0.438	0.303	0.459	0.301	0.459
Some college	0.287	0.452	0.266	0.442	0.293	0.455	0.282	0.450
College plus	0.244	0.429	0.296	0.456	0.202	0.402	0.229	0.420
Having one child	0.370	0.483	0.357	0.479	0.151	0.358	0.148	0.355
log real hh income last year	10.33	1.161	10.38	1.215	10.62	0.908	10.65	0.957
Jury exemption law	0.0662	0.249	0.375	0.484	0.0565	0.231	0.387	0.487
Indecency exemption law	0.264	0.441	0.374	0.484	0.261	0.439	0.366	0.482
Any-place law	0.360	0.480	0.892	0.311	0.359	0.480	0.890	0.313
N	34,392		10,864		493,318		151,748	
Spouse characteristics:								
Spouse age	31.84	6.242	32.37	6.596	33.68	6.876	33.90	7.036
Spouse married*	0.943	0.231	0.910	0.287	0.948	0.223	0.916	0.277
Spouse nonwhite	0.115	0.320	0.163	0.369	0.114	0.318	0.171	0.376
Spouse high school droupout	0.171	0.376	0.174	0.379	0.154	0.361	0.144	0.352
Spouse high school graduate	0.274	0.446	0.263	0.440	0.288	0.453	0.262	0.440
Spouse some college	0.269	0.444	0.241	0.428	0.304	0.460	0.285	0.451
Spouse college plus	0.286	0.452	0.322	0.467	0.254	0.435	0.309	0.462
Spouse in labor force	0.961	0.193	0.960	0.196	0.736	0.441	0.704	0.457
N	27,257		8,668		274,873		84,013	

Notes: *The CPS links a person's spouse/partner as the "spouse" used here. Thus, a person who is not married can have a "spouse".

Table A10: Summary Statistics of the Outcome Variables, the Current Population Survey, 1990-2010

VARIABLES	(1) N	(2) Mean	(3) SD	(4) N	(5) Mean	(6) SD	(1) N	(2) Mean	(3) SD	(4) N	(5) Mean	(6) SD
	Treat: Females with infant children						Control: Males					
	Workplace law=0			Workplace law=1			Workplace law=0			Workplace law=1		
Outcomes in the reference week:												
In labor force	34,392	0.569	0.495	10,864	0.550	0.497	493,318	0.886	0.318	151,748	0.872	0.334
Employed (if in labor force)	19,584	0.926	0.262	5,979	0.916	0.278	437,018	0.931	0.253	132,371	0.925	0.264
At work (if employed)	18,129	0.852	0.355	5,475	0.851	0.356	406,863	0.973	0.161	122,416	0.974	0.158
Part time (if at work)	15,444	0.430	0.495	4,658	0.410	0.492	396,017	0.162	0.369	119,288	0.176	0.380
log hours work (if at work)	15,444	3.351	0.625	4,658	3.375	0.624	396,017	3.677	0.431	119,288	3.651	0.448
Paid hourly (if at work)	15,444	0.144	0.351	4,658	0.137	0.344	396,017	0.129	0.336	119,288	0.126	0.332
log hourly wage if paid hourly	1,973	2.233	0.508	438	2.278	0.521	46,962	2.375	0.472	11,072	2.380	0.488
	Treat: Females with 1-year-old children						Control: Males					
	Workplace law=0			Workplace law=1			Workplace law=0			Workplace law=1		
Outcomes in the previous year:												
Employed last year	35,287	0.647	0.478	11,481	0.619	0.486	493,318	0.906	0.291	151,748	0.881	0.324
Full time last year (if employed)	22,819	0.643	0.479	7,108	0.672	0.469	447,171	0.885	0.319	133,718	0.879	0.326
log hourly wage last year	21,348	2.349	0.727	6,702	2.437	0.753	419,006	2.530	0.693	125,934	2.570	0.726

Notes: The table provides the summary statistics of the outcome variables for the treated and control groups, before and after the law, using the 1990-2010 Current Population Survey. The sample includes people aged 18-44. The dummy variable "In labor force" equals 1 if the individual participates in the labor force; otherwise it is 0. The dummy variable "Employed" is defined as individuals who are employed during the reference week of the survey, and it equals 1 if the individual works during the reference week, and 0 otherwise. The dummy variable "At work" is defined for individuals who are employed in the reference week, and it equals 1 if the individual works during the reference week, and 0 otherwise. The dummy variable "Part time" is defined for individuals who worked during the reference week (last week), and it equals 1 if the individual works part-time (less than 35 hours) during the reference week, and 0 otherwise. The variable "log hrs work" is defined for individuals who worked during the reference week. The variable "Paid hourly" is defined for individuals who worked in the reference week, and it equals 1 if the wage is paid by hour, and 0 otherwise. The variable "log hourly wage if paid hourly" is defined for individuals who received hourly paid wage in the reference week, and the wage is adjusted by the CPI variable in the CPS. The variable "Employed last year" equals 1 if the individual is employed, and 0 otherwise; note that it is not conditional on being in the labor force last year. The variable "Full time last year" is defined for individuals who were employed last year, and it equals 1 if the individual works full time, and 0 otherwise. The variable "log hourly wage last year" is the log real hourly wage last year (both hourly and non-hourly paid) adjusted by the CPI.

Table A11: Effects of Workplace Breastfeeding Benefits on Labor Market Outcomes in the Reference Week

	(1) All	(2) Single	(3) Married	(4) Married	(5) All	(6) Single	(7) Married	(8) Married
	Panel A: Dependent variable =in the labor force last week							
Law X mom of infants (control=males)	0.0116***	0.0114**	0.0141***	0.0129***				
	(0.00229)	(0.00545)	(0.00212)	(0.00215)				
Law X mom of infants (control=fathers of infants)					0.0142***	0.0101	0.0132***	0.0125***
					(0.00273)	(0.00739)	(0.00252)	(0.00253)
Spouse characteristics				Y				Y
Observations	690,313	266,755	423,558	369,529	81,270	11,657	69,613	66,090
R-squared	0.891	0.873	0.912	0.912	0.894	0.867	0.899	0.901
	Panel B: Dependent variable =employed last week, if in the labor force							
Law X mom of infants (control=males)	-0.00669	-0.00768	-0.00520	-0.00199				
	(0.00582)	(0.0158)	(0.00569)	(0.00598)				
Law X mom of infants (control=fathers of infants)					-0.00246	-0.00962	-0.00153	0.000111
					(0.00756)	(0.0368)	(0.00586)	(0.00638)
Spouse characteristics				Y				Y
Observations	594,943	206,572	388,371	341,116	60,123	7,498	52,625	50,615
R-squared	0.101	0.118	0.055	0.052	0.112	0.168	0.079	0.074
	Panel C: Dependent variable =working, if employed last week							
Law X mom of infants (control=males)	-0.00150	-0.0193	0.000942	7.10e-05				
	(0.00804)	(0.0198)	(0.00702)	(0.00652)				
Law X mom of infants (control=fathers of infants)					0.00332	-0.0321**	0.00697	0.00543
					(0.00693)	(0.0159)	(0.00735)	(0.00660)
Spouse characteristics				Y				Y
Observations	552,876	183,111	369,765	326,560	56,346	6,292	50,054	48,341
R-squared	0.026	0.014	0.036	0.040	0.069	0.087	0.075	0.078
	Panel D: Dependent variable =log hours of work if working last week							
Law X mom of infants (control=males)	0.0338**	-0.0330	0.0447***	0.0504***				
	(0.0149)	(0.0199)	(0.0157)	(0.0166)				
Law X mom of infants (control=fathers of infants)					0.0528***	-0.0158	0.0583***	0.0639***
					(0.0163)	(0.0329)	(0.0170)	(0.0174)

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Table A11 – Continued

	(1) All	(2) Single	(3) Married	(4) Married	(5) All	(6) Single	(7) Married	(8) Married
Spouse characteristics				Y				Y
Observations	535,400	177,537	357,863	316,077	51,975	5,791	46,184	44,665
R-squared	0.140	0.179	0.077	0.083	0.162	0.163	0.167	0.173
	Panel E: Dependent variable =part time (less than 35h) if working last week							
Law X mom of infants (control=males)	-0.0313*	0.0395*	-0.0459***	-0.0470***				
	(0.0158)	(0.0228)	(0.0139)	(0.0137)				
Law X mom of infants (control=fathers of infants)					-0.0413**	0.0246	-0.0500***	-0.0509***
					(0.0158)	(0.0304)	(0.0147)	(0.0141)
Spouse characteristics				Y				Y
Observations	535,400	177,537	357,863	316,077	51,975	5,791	46,184	44,665
R-squared	0.143	0.190	0.067	0.072	0.158	0.183	0.157	0.161
	Panel F: Dependent variable =paid hourly wage, if working last week							
Law X mom of infants (control=males)	-0.00800	-0.00227	-0.00993	-0.0106				
	(0.00836)	(0.0198)	(0.00929)	(0.00947)				
Law X mom of infants (control=fathers of infants)					-0.0106*	-0.0363	-0.0101	-0.0113
					(0.00623)	(0.0269)	(0.00707)	(0.00770)
Spouse characteristics				Y				Y
Observations	535,400	177,537	357,863	316,077	51,975	5,791	46,184	44,665
R-squared	0.035	0.028	0.036	0.038	0.051	0.076	0.052	0.054
	Panel G: Dependent variable =log real hourly wage, if paid hour last week							
Law X mom of infants (control=males)	0.0373	0.0354	0.0465	0.0667				
	(0.0307)	(0.0330)	(0.0382)	(0.0405)				
Law X mom of infants (control=fathers of infants)					0.0327	0.0513	0.0213	0.0469
					(0.0400)	(0.0768)	(0.0428)	(0.0368)
Spouse characteristics				Y				Y
Observations	60,445	25,491	34,954	29,781	5,506	930	4,576	4,356
R-squared	0.425	0.380	0.338	0.348	0.455	0.567	0.430	0.435

Notes: Standard errors in parentheses and are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1.

Table A12: Effects of Workplace Breastfeeding Benefits on Labor Market Outcomes During the Previous Year

	(1) All	(2) Single	(3) Married	(4) Married	(5) All	(6) Single	(7) Married	(8) Married
	Panel A: Dependent variable =Employed last year (not conditional on in the labor force)							
Law last year X mom of 1-yr-old (control=males)	-0.00545	0.0206	-0.0164***	-0.0204***				
	(0.00511)	(0.0149)	(0.00508)	(0.00514)				
Law last year X mom of 1-yr-old (control=fathers of 1-yr-old)					-0.0151**	-0.00827	-0.0185***	-0.0197***
					(0.00568)	(0.0187)	(0.00558)	(0.00500)
Spouse characteristics				Y				Y
Observations	691,825	266,403	425,422	370,671	83,154	10,858	72,296	67,975
R-squared	0.512	0.459	0.574	0.585	0.610	0.488	0.637	0.649
	Panel B: Dependent variable =Full time last year, if employed last year							
Law last year X mom of 1-yr-old (control=males)	0.0385**	0.00428	0.0445***	0.0426**				
	(0.0168)	(0.0220)	(0.0152)	(0.0161)				
Law last year X mom of 1-yr-old (control=fathers of 1-yr-old)					0.0431**	0.000341	0.0480***	0.0461**
					(0.0167)	(0.0262)	(0.0163)	(0.0174)
Spouse characteristics				Y				Y
Observations	610,807	216,630	394,177	345,880	65,045	7,591	57,454	54,665
R-squared	0.221	0.222	0.129	0.145	0.217	0.189	0.229	0.239
	Panel C: Dependent variable =log real hourly wage last year							
Law last year X mom of 1-yr-old (control=males)	0.0183*	-0.0379*	0.0339***	0.0456***				
	(0.0106)	(0.0220)	(0.0111)	(0.0110)				
Law last year X mom of 1-yr-old (control=fathers of 1-yr-old)					0.0193**	-0.0627**	0.0312***	0.0468***
					(0.00900)	(0.0306)	(0.0107)	(0.00955)
Spouse characteristics				Y				Y
Observations	572,983	206,925	366,058	321,120	60,887	7,310	53,577	50,949
R-squared	0.361	0.259	0.319	0.336	0.400	0.244	0.381	0.386

Notes: Standard errors in parentheses and are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1.

Table A13: Robustness: Alternative Specifications for Labor Market Outcomes

	(1) baseline	(2) unweighted	(3) state cov	(4) state trends	(5) region by year FE	(6) no CA	(7) add gender wage gap	(8) other bf law
	Panel A: Dependent variable = in labor force							
Workplace X mom of infants	0.0129***	0.0125***	0.0125***	0.0129***	0.0129***	0.0117***	0.00684**	0.00305
	(0.00215)	(0.00219)	(0.00219)	(0.00215)	(0.00215)	(0.00240)	(0.00337)	(0.00276)
July X mom of infants								0.00753***
								(0.00256)
Indecency X mom of infants								0.00985***
								(0.00273)
Any place X mom of infants								0.0116***
								(0.00287)
Observations	369,529	369,533	369,533	369,529	369,529	334,850	238,192	369,529
R-squared	0.912	0.915	0.915	0.912	0.912	0.910	0.825	0.912
	Panel B: Dependent variable = employed, if in labor force							
Workplace × mom of infants	-0.00199	-0.000141	0.000141	-0.00194	-0.00185	-0.00243	0.00363	-0.00479
	(0.00598)	(0.00621)	(0.00624)	(0.00603)	(0.00605)	(0.00760)	(0.00522)	(0.00661)
Jury × mom of infants								0.00779
								(0.00731)
Indecency × mom of infants								0.00513
								(0.00538)
Any place × mom of infants								-0.000798
								(0.00496)
Observations	341,116	341,120	341,120	341,116	341,116	309,713	230,869	341,116
R-squared	0.052	0.050	0.052	0.053	0.053	0.051	0.045	0.052
	Panel C: Dependent variable = worked in the reference week, if employed							
Workplace × mom of infants	7.10e-05	-0.000840	-0.000789	-7.76e-06	2.81e-05	0.00441	-0.00156	0.0104
	(0.00652)	(0.00646)	(0.00646)	(0.00651)	(0.00655)	(0.00686)	(0.00731)	(0.00726)
Jury × mom of infants								-0.00628
								(0.0103)
Indecency × mom of infants								-0.00115
								(0.00778)
Any place × mom of infants								-0.0139*
								(0.00752)
Observations	326,560	326,564	326,564	326,560	326,560	296,963	222,071	326,560
R-squared	0.040	0.036	0.036	0.040	0.041	0.039	0.050	0.040
	Panel D: Dependent variable = log hours worked in the reference week, if workded							
Workplace × mom of infants	0.0504***	0.0503***	0.0504***	0.0508***	0.0508***	0.0424**	0.0443**	0.0381*
	(0.0166)	(0.0172)	(0.0172)	(0.0165)	(0.0165)	(0.0193)	(0.0188)	(0.0197)
Jury × mom of infants								-0.0265
								(0.0244)
Indecency × mom of infants								-0.0127

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Table A13 – Continued

	(1) baseline	(2) unweighted	(3) state cov	(4) state trends	(5) region by year FE	(6) no CA	(7) add gender wage gap	(8) other bf law
								(0.0177)
Any place × mom of infants								0.0401**
								(0.0164)
Observations	316,077	316,081	316,081	316,077	316,077	287,341	214,865	316,077
R-squared	0.083	0.086	0.086	0.083	0.084	0.084	0.079	0.083
	Panel E: Dependent variable = part time (less than 35h) in the reference week, if worked							
Workplace × mom of infants	-0.0470***	-0.0352**	-0.0354**	-0.0473***	-0.0475***	-0.0476***	-0.0490***	-0.0442**
	(0.0137)	(0.0136)	(0.0136)	(0.0137)	(0.0136)	(0.0164)	(0.0151)	(0.0177)
Jury × mom of infants								0.0343**
								(0.0134)
Indecency × mom of infants								0.00534
								(0.0173)
Any place × mom of infants								-0.0273
								(0.0199)
Observations	316,077	316,081	316,081	316,077	316,077	287,341	214,865	316,077
R-squared	0.072	0.074	0.074	0.073	0.073	0.075	0.074	0.072
	Panel F: Dependent variable = paid by hour in the reference week, if worked							
Workplace × mom of infants	-0.0106	-0.00513	-0.00515	-0.0109	-0.0107	-0.00806	-0.0149*	-0.000740
	(0.00947)	(0.00913)	(0.00912)	(0.00946)	(0.00945)	(0.0123)	(0.00873)	(0.00974)
Jury × mom of infants								0.00360
								(0.00965)
Indecency × mom of infants								0.0141
								(0.00847)
Any place × mom of infants								-0.0216***
								(0.00756)
Observations	316,077	316,081	316,081	316,077	316,077	287,341	214,865	316,077
R-squared	0.038	0.037	0.037	0.039	0.039	0.040	0.038	0.039
	Panel G: Dependent variable = log real hourly wage in the reference week, if paid by hour							
Workplace × mom of infants	0.0667	0.0319	0.0318	0.0684*	0.0695*	0.0433	0.0718*	0.0619
	(0.0405)	(0.0290)	(0.0289)	(0.0399)	(0.0388)	(0.0448)	(0.0382)	(0.0564)
Jury × mom of infants								-0.0176
								(0.0427)
Indecency × mom of infants								0.0375
								(0.0366)
Any place × mom of infants								0.00481
								(0.0393)
Observations	29,781	29,781	29,781	29,781	29,781	27,185	22,330	29,781
R-squared	0.348	0.353	0.353	0.353	0.354	0.345	0.379	0.349
	Panel H: Dependent variable = employed last year, unconditional							
Workplace last year × mom of 1 year old	-0.0204***	-0.0137**	-0.0138**	-0.0206***	-0.0205***	-0.0161***	0	-0.0126***
	(0.00514)	(0.00586)	(0.00586)	(0.00513)	(0.00514)	(0.00588)	(0)	(0.00457)
Jury last year × mom of 1 year old								-0.00168
								(0.00917)
Indecency last year × mom of 1 year old								0.0126**

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Table A13 – Continued

	(1) baseline	(2) unweighted	(3) state cov	(4) state trends	(5) region by year FE	(6) no CA	(7) add gender wage gap	(8) other bf law
								(0.00535)
Any place last year × mom of 1 year old								-0.0136***
								(0.00440)
Observations	370,671	370,675	370,675	370,671	370,671	335,856	237,369	370,671
R-squared	0.585	0.585	0.585	0.586	0.586	0.585		0.585
	Panel I: Dependent variable = full time last year, if employed							
Workplace last year × mom of 1 year old	0.0426**	0.0367**	0.0368**	0.0426**	0.0427**	0.0442**	0.0423**	0.0221
	(0.0161)	(0.0160)	(0.0160)	(0.0161)	(0.0160)	(0.0199)	(0.0175)	(0.0173)
Jury last year × mom of 1 year old								-0.0284
								(0.0188)
Indecency last year × mom of 1 year old								-0.00831
								(0.0155)
Any place last year × mom of 1 year old								0.0519***
								(0.0152)
Observations	345,880	345,884	345,884	345,880	345,880	314,174	237,369	345,880
R-squared	0.145	0.150	0.150	0.145	0.145	0.151	0.164	0.145
	Panel J: Dependent variable = log real hourly wage last year							
Workplace last year × mom of 1 year old	0.0456***	0.0387***	0.0388***	0.0453***	0.0454***	0.0414***	0.0118	0.0238
	(0.0110)	(0.0110)	(0.0111)	(0.0110)	(0.0108)	(0.0112)	(0.0111)	(0.0165)
Jury last year × mom of 1 year old								0.00632
								(0.0161)
Indecency last year × mom of 1 year old								-0.00809
								(0.0126)
Any place last year × mom of 1 year old								0.0342**
								(0.0170)
Observations	321,120	321,123	321,123	321,120	321,120	291,927	237,369	321,120
R-squared	0.336	0.336	0.336	0.337	0.337	0.332	0.566	0.336

Notes: Standard errors in parentheses and are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1.

Table A14: Balance check: Characteristics among females with infant children, by Workplace Breastfeeding Benefits

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: all							
VARIABLES	age	nonwhite	hdropout	hgrad	somecol	colgrad	married	firstchild
Workplace Law	0.109	0.00973	-0.0213***	0.0127*	0.00632	0.00226	-5.41e-05	0.0133
	(0.103)	(0.00665)	(0.00696)	(0.00770)	(0.00801)	(0.00764)	(0.00701)	(0.00869)
Observations	45,256	45,256	45,256	45,256	45,256	45,256	45,256	45,256
R-squared	0.033	0.084	0.116	0.038	0.011	0.053	0.018	0.004
VARIABLES	log hh inc	sp age	sp nonwhite	sp married	sp hgrad	sp somecol	sp colgrad	sp in lab force
Workplace Law	0.0486**	-0.0645	0.00427	-0.00192	-0.00988	0.00926	0.00725	0.00515
	(0.0217)	(0.128)	(0.00667)	(0.00496)	(0.00869)	(0.00878)	(0.00900)	(0.00401)
Observations	43,786	35,925	35,925	35,925	35,925	35,925	35,925	35,925
R-squared	0.033	0.031	0.069	0.031	0.042	0.015	0.042	0.004
	Panel B: in labor force							
VARIABLES	age	nonwhite	hdropout	hgrad	somecol	colgrad	married	firstchild
Workplace Law	0.145	0.00775	-0.0211***	0.00416	0.0122	0.00477	-0.00157	0.00868
	(0.134)	(0.00897)	(0.00787)	(0.0101)	(0.0111)	(0.0108)	(0.00929)	(0.0119)
Observations	25,563	25,563	25,563	25,563	25,563	25,563	25,563	25,563
R-squared	0.036	0.099	0.114	0.036	0.013	0.056	0.022	0.008
VARIABLES	log hh inc	sp age	sp nonwhite	sp married	sp hgrad	sp somecol	sp colgrad	sp in lab force
Workplace Law	0.0677***	-0.198	-0.000261	-0.00374	-0.00969	0.0146	0.00190	0.00751
	(0.0255)	(0.163)	(0.00905)	(0.00663)	(0.0115)	(0.0122)	(0.0123)	(0.00540)
Observations	25,306	20,585	20,585	20,585	20,585	20,585	20,585	20,585
R-squared	0.033	0.034	0.084	0.032	0.039	0.016	0.041	0.006
	Panel C: hours worked last week>0							
VARIABLES	age	nonwhite	hdropout	hgrad	somecol	colgrad	married	firstchild

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Table A14 – Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Workplace Law	0.220	0.00892	-0.0192**	-0.00186	0.0149	0.00618	0.00142	0.00551
	(0.150)	(0.00981)	(0.00858)	(0.0114)	(0.0126)	(0.0123)	(0.0102)	(0.0134)
Observations	20,102	20,102	20,102	20,102	20,102	20,102	20,102	20,102
R-squared	0.034	0.098	0.121	0.037	0.014	0.056	0.023	0.008
VARIABLES	log hh inc	sp age	sp nonwhite	sp married	sp hgrad	sp somecol	sp colgrad	sp in lab force
Workplace Law	0.0777***	-0.00121	0.00249	0.00294	-0.0148	0.0210	-0.000273	0.00597
	(0.0270)	(0.182)	(0.00999)	(0.00736)	(0.0129)	(0.0136)	(0.0137)	(0.00614)
Observations	19,955	16,459	16,459	16,459	16,459	16,459	16,459	16,459
R-squared	0.033	0.033	0.083	0.032	0.039	0.016	0.039	0.008
	Panel D: hourly wage (paid by hour) known							
VARIABLES	age	nonwhite	hdropout	hgrad	somecol	colgrad	married	firstchild
Workplace Law	0.230	0.0683**	-0.0356	0.0181	-0.00607	0.0236	-0.00789	-0.00597
	(0.464)	(0.0314)	(0.0290)	(0.0375)	(0.0385)	(0.0295)	(0.0348)	(0.0403)
Observations	2,411	2,411	2,411	2,411	2,411	2,411	2,411	2,411
R-squared	0.060	0.176	0.177	0.064	0.043	0.050	0.070	0.033
VARIABLES	log hh inc	sp age	sp nonwhite	sp married	sp hgrad	sp somecol	sp colgrad	sp in lab force
Workplace Law	0.0113	0.252	0.110***	0.0306	0.0423	0.0770*	-0.0636*	-0.00582
	(0.0845)	(0.586)	(0.0346)	(0.0266)	(0.0445)	(0.0444)	(0.0373)	(0.0182)
Observations	2,390	1,804	1,804	1,804	1,804	1,804	1,804	1,804
R-squared	0.074	0.064	0.158	0.091	0.090	0.056	0.063	0.055

Notes: The table shows estimates of β in equation (1.6): whether each individual's characteristics differs according to the workplace breastfeeding benefits status, for females with infant children. *** p<0.01, ** p<0.05, * p<0.1.

Table A15: Balance check: Characteristics among females with one year olds, by Workplace Breastfeeding Benefits

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: all							
VARIABLES	age	nonwhite	hdropout	hgrad	somecol	colgrad	married	firstchild
Workplace Law	0.116	0.00511	-0.0198***	-0.00468	0.0165**	0.00802	0.0110	0.0222***
	(0.103)	(0.00661)	(0.00677)	(0.00763)	(0.00798)	(0.00754)	(0.00675)	(0.00861)
Observations	46,768	46,768	46,768	46,768	46,768	46,768	46,768	46,768
R-squared	0.031	0.090	0.120	0.037	0.009	0.049	0.018	0.003
VARIABLES	log hh inc	sp age	sp nonwhite	sp married	sp hgrad	sp somecol	sp colgrad	sp in lab force
Workplace Law	0.0531***	0.155	0.00198	0.00379	0.00984	-0.00740	0.00500	-0.000735
	(0.0206)	(0.127)	(0.00664)	(0.00454)	(0.00862)	(0.00876)	(0.00899)	(0.00401)
Observations	45,439	36,624	36,624	36,624	36,624	36,624	36,624	36,624
R-squared	0.032	0.028	0.078	0.025	0.036	0.015	0.038	0.004
	Panel B: employed last year							
VARIABLES	age	nonwhite	hdropout	hgrad	somecol	colgrad	married	firstchild
Workplace Law	0.0765	0.00633	-0.0206***	-0.0180*	0.0232**	0.0154	0.00191	0.0246**
	(0.128)	(0.00832)	(0.00740)	(0.00950)	(0.0104)	(0.00997)	(0.00843)	(0.0111)
Observations	29,927	29,927	29,927	29,927	29,927	29,927	29,927	29,927
R-squared	0.034	0.105	0.124	0.037	0.009	0.048	0.022	0.005
VARIABLES	log hh inc	sp age	sp nonwhite	sp married	sp hgrad	sp somecol	sp colgrad	sp in lab force
Workplace Law	0.0487**	0.303*	-0.00186	0.00340	0.00550	-0.0103	0.0187	-0.00538
	(0.0224)	(0.156)	(0.00862)	(0.00585)	(0.0109)	(0.0114)	(0.0114)	(0.00505)
Observations	29,905	23,666	23,666	23,666	23,666	23,666	23,666	23,666
R-squared	0.035	0.031	0.090	0.025	0.035	0.014	0.036	0.006
	Panel C: full time last year							
VARIABLES	age	nonwhite	hdropout	hgrad	somecol	colgrad	married	firstchild

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Table A15 – Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Workplace Law	0.0765	0.00633	-0.0206***	-0.0180*	0.0232**	0.0154	0.00191	0.0246**
	(0.128)	(0.00832)	(0.00740)	(0.00950)	(0.0104)	(0.00997)	(0.00843)	(0.0111)
Observations	29,927	29,927	29,927	29,927	29,927	29,927	29,927	29,927
R-squared	0.034	0.105	0.124	0.037	0.009	0.048	0.022	0.005
VARIABLES	log hh inc	sp age	sp nonwhite	sp married	sp hgrad	sp somecol	sp colgrad	sp in lab force
Workplace Law	0.0487**	0.303*	-0.00186	0.00340	0.00550	-0.0103	0.0187	-0.00538
	(0.0224)	(0.156)	(0.00862)	(0.00585)	(0.0109)	(0.0114)	(0.0114)	(0.00505)
Observations	29,905	23,666	23,666	23,666	23,666	23,666	23,666	23,666
R-squared	0.035	0.031	0.090	0.025	0.035	0.014	0.036	0.006
	Panel D: hourly wage last year known							
VARIABLES	age	nonwhite	hdropout	hgrad	somecol	colgrad	married	firstchild
Workplace Law	0.0310	0.00534	-0.0223***	-0.0178*	0.0275**	0.0126	-0.000217	0.0272**
	(0.132)	(0.00869)	(0.00768)	(0.00986)	(0.0107)	(0.0103)	(0.00880)	(0.0115)
Observations	28,050	28,050	28,050	28,050	28,050	28,050	28,050	28,050
R-squared	0.034	0.107	0.124	0.038	0.009	0.047	0.021	0.005
VARIABLES	log hh inc	sp age	sp nonwhite	sp married	sp hgrad	sp somecol	sp colgrad	sp in lab force
Workplace Law	0.0412*	0.319**	-0.00181	0.00293	0.00892	-0.0113	0.0170	-0.00554
	(0.0229)	(0.161)	(0.00903)	(0.00615)	(0.0113)	(0.0118)	(0.0118)	(0.00532)
Observations	28,040	22,036	22,036	22,036	22,036	22,036	22,036	22,036
R-squared	0.035	0.032	0.091	0.026	0.036	0.013	0.036	0.007

Notes: The table shows estimates of β in equation (1.6): whether each individual's characteristics differs according to the workplace breastfeeding benefits status, for females whose youngest child is 1 year old. *** p<0.01, ** p<0.05, * p<0.1.

Table A16: Impact of Workplace Breastfeeding Benefits on Labor Market Outcomes, by Types of Law

	(1)	(2)	(3)	(4)	(5)
	Panel A: Dependent variable = in labor force				
longer break× mom of infants	0.00566				
	(0.00574)				
bf and pump× mom of infants		0.00871*			
		(0.00480)			
no discrimination× mom of infants			0.00627*		
			(0.00349)		
protection× mom of infants				0.0116***	
				(0.00309)	
encourage× mom of infants					0.00859***
					(0.00270)
Observations	218,089	197,739	230,292	217,707	221,395
R-squared	0.911	0.910	0.912	0.912	0.910
	Panel B: Dependent variable = employed, if in labor force				
longer break× mom of infants	0.0143**				
	(0.00668)				
bf and pump× mom of infants		0.00212			
		(0.0129)			
no discrimination× mom of infants			0.0105**		
			(0.00485)		
protection× mom of infants				0.00755	
				(0.0107)	
encourage× mom of infants					-0.0186***
					(0.00522)
Observations	201,747	183,213	212,900	201,429	205,091
R-squared	0.053	0.054	0.053	0.053	0.053
	Panel C: Dependent variable = working in the reference week, if employed				
longer break× mom of infants	0.00667				
	(0.0176)				
bf and pump× mom of infants		0.0155			
		(0.0212)			
no discrimination× mom of infants			-0.00184		
			(0.00909)		

Continued on Next Page. . .

Table A16 – Continued

	(1)	(2)	(3)	(4)	(5)
protection× mom of infants				-0.0157**	
				(0.00618)	
encourage× mom of infants					-0.00423
					(0.00719)
Observations	193,474	175,773	204,105	193,162	196,927
R-squared	0.043	0.042	0.042	0.043	0.040
	Panel D: Dependent variable = part time in the reference week (less than 35h), if employed				
longer break× mom of infants	-0.0864**				
	(0.0329)				
bf and pump× mom of infants		0.0150			
		(0.0203)			
no discrimination× mom of infants			-0.0403		
			(0.0467)		
protection× mom of infants				-0.0559*	
				(0.0317)	
encourage× mom of infants					-0.0412
					(0.0249)
Observations	187,339	170,167	197,507	186,982	190,614
R-squared	0.080	0.082	0.079	0.079	0.077
	Panel E: Dependent variable = log hours work in the reference week, if working				
longer break× mom of infants	0.0979**				
	(0.0414)				
bf and pump× mom of infants		0.0222			
		(0.0297)			
no discrimination× mom of infants			0.0424		
			(0.0642)		
protection× mom of infants				0.0372	
				(0.0424)	
encourage× mom of infants					0.0366
					(0.0307)
Observations	187,339	170,167	197,507	186,982	190,614
R-squared	0.091	0.092	0.091	0.091	0.086
	Panel F: Dependent variable = being paid by hour in the reference week, if worked				
longer break× mom of infants	0.0229				
	(0.0147)				
bf and pump× mom of infants		0.0106			
		(0.00810)			
no discrimination× mom of infants			0.00427		

Continued on Next Page. . .

Table A16 – Continued

	(1)	(2)	(3)	(4)	(5)
			(0.0200)		
protection× mom of infants				0.0300***	
				(0.00896)	
encourage× mom of infants					-0.0356***
					(0.00805)
Observations	187,339	170,167	197,507	186,982	190,614
R-squared	0.041	0.042	0.042	0.043	0.040
	Panel G: Dependent variable = log real hourly wage in the reference week, if paid by hour				
longer break× mom of infants	0.201***				
	(0.0624)				
bf and pump× mom of infants		0.0609			
		(0.0515)			
no discrimination× mom of infants			0.116		
			(0.0750)		
protection× mom of infants				0.00873	
				(0.103)	
encourage× mom of infants					0.142***
					(0.0376)
Observations	17,973	16,599	19,116	18,044	18,401
R-squared	0.333	0.341	0.338	0.332	0.352
	Panel H: Dependent variable = employed last year (unconditional)				
longer break last yr× mom of 1 yr old	-0.00570				
	(0.0110)				
bf and pump last yr× mom of 1 yr old		-0.0103			
		(0.00635)			
no discrimination× mom of 1 yr old			-0.0106***		
			(0.00341)		
protection last yr× mom of 1 yr old				-0.00137	
				(0.0113)	
encourage last yr× mom of 1 yr old					-0.0246***
					(0.00381)
Observations	221,539	201,136	233,529	220,788	224,706
R-squared	0.593	0.587	0.590	0.594	0.588
	Panel I: Dependent variable = employed full time last year, if employed				
longer break last yr× mom of 1 yr old	0.0468				
	(0.0425)				
bf and pump last yr× mom of 1 yr old		-0.0198			
		(0.0388)			

Continued on Next Page. . .

Table A16 – Continued

	(1)	(2)	(3)	(4)	(5)
no discrimination× mom of 1 yr old			0.0119		
			(0.0389)		
protection last yr× mom of 1 yr old				0.0382	
				(0.0401)	
encourage last yr× mom of 1 yr old					0.0618**
					(0.0238)
Observations	207,256	188,514	218,350	206,544	210,614
R-squared	0.156	0.160	0.158	0.153	0.151
	Panel J: Dependent variable = log real hourly wage last year				
longer break last yr× mom of 1 yr old	0.0812***				
	(0.0262)				
bf and pump last yr× mom of 1 yr old		0.0703***			
		(0.0134)			
no discrimination× mom of 1 yr old			0.0640***		
			(0.0189)		
protection last yr× mom of 1 yr old				0.0533**	
				(0.0201)	
encourage last yr× mom of 1 yr old					0.0325***
					(0.00838)
Observations	192,721	175,437	202,857	191,945	195,810
R-squared	0.326	0.330	0.327	0.326	0.337

Notes: Standard errors in parentheses and are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1.

Table A17: Occupational Characteristics of Temporal Flexibility, the CPS Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
		Workplace= 0			Workplace =1			Workplace =0			Workplace =1	
VARIABLES	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Females with youngest child of 0 year old	34,392	1	0	10,864	1	0	493,318	0	0	151,748	0	0
Less Flexibility (average of the five characteristics)	20,630	0.0725	1.026	6,142	0.137	0.980	439,670	-0.0503	0.984	132,598	-0.0353	0.981
Time pressure	20,630	-0.190	1.093	6,142	-0.166	1.063	439,670	0.163	0.884	132,598	0.143	0.898
Contact with others	20,630	0.240	0.927	6,142	0.311	0.859	439,670	-0.223	1.018	132,598	-0.168	1.009
Establishing and maintaining interpersonal relationships	20,630	0.226	0.923	6,142	0.296	0.873	439,670	-0.210	1.013	132,598	-0.160	1.029
Structured vs. unstructured work	20,630	0.0863	1.008	6,142	0.124	0.955	439,670	-0.0475	1.003	132,598	-0.0533	1.001
Freedom to make decisions	20,630	-0.0709	1.061	6,142	-0.0662	1.034	439,670	0.107	0.949	132,598	0.0828	0.950
	(1)	(2)	(3)	(4)	(5)	(6)						
		Workplace= 0			Workplace =1							
VARIABLES	N	Mean	SD	N	Mean	SD						
Females with youngest child of 1 year old	35,287	1	0	11,481	1	0						
Less Flexibility (average of the five characteristics)	22,252	0.0553	1.023	6,965	0.103	0.997						
Time pressure	22,252	-0.195	1.095	6,965	-0.203	1.061						
Contact with others	22,252	0.213	0.941	6,965	0.263	0.885						
Establishing and maintaining interpersonal relationships	22,252	0.208	0.931	6,965	0.279	0.896						
Structured vs. unstructured work	22,252	0.0820	1.008	6,965	0.111	0.973						
Freedom to make decisions	22,252	-0.0726	1.054	6,965	-0.0566	1.046						

Notes: The definitions for the five characteristics are: 1. Time pressure: How often does this job require the worker to meet strict deadlines? 2. Contact with others: How much does this job require the worker to be in contact with others (face-to-face, by telephone, or otherwise) in order to perform it? 3. Establishing and maintaining interpersonal relationships: Developing constructive and cooperative working relationships with others and maintaining them over time. 4. Structured versus unstructured work: To what extent is this job structured for the worker, rather than allowing the worker to determine tasks, priorities, and goals? 5. Freedom to make decisions: How much decision making freedom, without supervision, does the job offer. The variable $LessFlexibility_i$ is defined as the average of the five characteristics for each occupation. I merge the occupational characteristics for individual with occupational information in the CPS sample. The occupation variable in the CPS is "occ2010"; I use the crosswalk between occ2010 and the 2010 SOC to link the occupation to its characteristics in the O*NET. Because the O*NET occupations are cross-referenced by the industry, I weigh the detailed occupation characteristics by the number of observations in each occupations, so that the characteristics can be matched to the CPS occupations. I then normalize the characteristics to have a mean zero and a standard deviation of 1, à la the approach in (Goldin, 2014).

Table A18: Effects of the Workplace Breastfeeding Benefits through Flexibility in Labor Force Participation

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Dependent variable = in labor force					
workplace × mom of infants	0.0213***	0.0183***	0.0212***	0.0194***	0.0212***	0.0195***
	(0.00410)	(0.00379)	(0.00384)	(0.00452)	(0.00419)	(0.00384)
workplace × mom of infants ×non-flexible	-0.0110***					
	(0.00370)					
workplace × mom of infants ×time pressure		-0.0127***				
		(0.00369)				
workplace × mom of infants ×contact others			-0.00622*			
			(0.00341)			
workplace × mom of infants ×establish relationship				-0.00103		
				(0.00431)		
workplace × mom of infants ×structured workplace					-0.00865**	
					(0.00361)	
workplace × mom of infants ×freedom making decisions						-0.00477
						(0.00357)
Observations	342,640	342,640	342,640	342,640	342,640	342,640
R-squared	0.031	0.030	0.028	0.029	0.030	0.030
	Panel B: Dependent variable = employed, if in labor force					
workplace × mom of infants	-0.00167	-0.00147	-0.000747	-0.00316	-0.00318	-0.00231
	(0.00747)	(0.00602)	(0.00644)	(0.00723)	(0.00686)	(0.00639)
workplace × mom of infants ×non-flexible	-0.000440					
	(0.00659)					
workplace × mom of infants ×time pressure		-0.00878*				
		(0.00520)				
workplace × mom of infants ×contact others			-0.00541			
			(0.00445)			
workplace × mom of infants ×establish relationship				0.00514		
				(0.00550)		
workplace × mom of infants ×structured workplace					0.00771	
					(0.00542)	
workplace × mom of infants ×freedom making decisions						0.00187
						(0.00510)

Continued on Next Page. . .

Table A18 – Continued

	(1)	(2)	(3)	(4)	(5)	(6)
Observations	340,520	340,520	340,520	340,520	340,520	340,520
R-squared	0.041	0.039	0.039	0.041	0.041	0.040
	Panel C: Dependent variable = worked in the reference week, if employed					
workplace × mom of infants	0.00107	0.000454	0.000177	0.00178	0.00120	0.000475
	(0.00610)	(0.00673)	(0.00598)	(0.00710)	(0.00655)	(0.00644)
workplace × mom of infants ×non-flexible	0.00102					
	(0.00895)					
workplace × mom of infants ×time pressure		0.00231				
		(0.00818)				
workplace × mom of infants ×contact others			0.00378			
			(0.00849)			
workplace × mom of infants ×establish relationship				0.000964		
				(0.0119)		
workplace × mom of infants ×structured workplace					-0.00144	
					(0.0113)	
workplace × mom of infants ×freedom making decisions						-0.00226
						(0.00763)
Observations	326,160	326,160	326,160	326,160	326,160	326,160
R-squared	0.040	0.040	0.040	0.040	0.040	0.040
	Panel D: Dependent variable = log hours worked in the reference week, if worked					
workplace × mom of infants	0.0426***	0.0499***	0.0473***	0.0427**	0.0477***	0.0479***
	(0.0157)	(0.0175)	(0.0162)	(0.0170)	(0.0161)	(0.0160)
workplace × mom of infants ×non-flexible	0.0309**					
	(0.0153)					
workplace × mom of infants ×time pressure		0.0132				
		(0.0152)				
workplace × mom of infants ×contact others			0.0277			
			(0.0188)			
workplace × mom of infants ×establish relationship				0.0257*		
				(0.0147)		
workplace × mom of infants ×structured workplace					0.0131	
					(0.0115)	
workplace × mom of infants ×freedom making decisions						0.0186
						(0.0149)
Observations	315,694	315,694	315,694	315,694	315,694	315,694
R-squared	0.088	0.085	0.086	0.085	0.086	0.086

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Table A18 – Continued

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel E: Dependent variable = part time (less than 35h) last week, if worked					
workplace × mom of infants	-0.0421***	-0.0468***	-0.0467***	-0.0444***	-0.0441***	-0.0460***
	(0.0124)	(0.0140)	(0.0128)	(0.0125)	(0.0137)	(0.0131)
workplace × mom of infants ×non-flexible	-0.0152					
	(0.0144)					
workplace × mom of infants ×time pressure		-0.00768				
		(0.0105)				
workplace × mom of infants ×contact others			-0.00965			
			(0.0131)			
workplace × mom of infants ×establish relationship				-0.0102		
				(0.0139)		
workplace × mom of infants ×structured workplace					-0.00860	
					(0.0112)	
workplace × mom of infants ×freedom making decisions						-0.00730
						(0.00974)
Observations	315,694	315,694	315,694	315,694	315,694	315,694
R-squared	0.075	0.074	0.073	0.073	0.074	0.073
	Panel F: Dependent variable = paid by hour last week, if worked					
workplace × mom of infants	-0.00761	-0.00937	-0.0104	-0.0120	-0.00897	-0.00757
	(0.0107)	(0.00982)	(0.00874)	(0.0110)	(0.0106)	(0.00958)
workplace × mom of infants ×non-flexible	-0.0158*					
	(0.00829)					
workplace × mom of infants ×time pressure		-0.00788				
		(0.00801)				
workplace × mom of infants ×contact others			-0.0129			
			(0.0104)			
workplace × mom of infants ×establish relationship				-0.00560		
				(0.00917)		
workplace × mom of infants ×structured workplace					-0.00891	
					(0.00675)	
workplace × mom of infants ×freedom making decisions						-0.0166**
						(0.00686)
Observations	315,694	315,694	315,694	315,694	315,694	315,694
R-squared	0.045	0.039	0.041	0.045	0.044	0.042
	Panel G: Dependent variable = log real hourly wage last week, if paid by hour					

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Table A18 – Continued

	(1)	(2)	(3)	(4)	(5)	(6)
workplace × mom of infants	0.0676*	0.0656	0.0683*	0.0557	0.0680*	0.0735*
	(0.0377)	(0.0424)	(0.0386)	(0.0366)	(0.0389)	(0.0437)
workplace × mom of infants ×non-flexible	-0.0350					
	(0.0488)					
workplace × mom of infants ×time pressure		-0.0478				
		(0.0439)				
workplace × mom of infants ×contact others			-0.0244			
			(0.0275)			
workplace × mom of infants ×establish relationship				-0.0161		
				(0.0515)		
workplace × mom of infants ×structured workplace					-0.0457	
					(0.0373)	
workplace × mom of infants ×freedom making decisions						-0.00399
						(0.0329)
Observations	29,755	29,755	29,755	29,755	29,755	29,755
R-squared	0.362	0.354	0.348	0.355	0.359	0.361
	Panel H: Dependent variable = employed last year, unconditional					
workplace last year × mom of 1 year old	0.00623	0.00733*	0.00566	0.00521	0.00572	0.00758*
	(0.00486)	(0.00414)	(0.00487)	(0.00607)	(0.00507)	(0.00434)
workplace last year X mom of 1 year old X non-flexible	0.00325					
	(0.00502)					
workplace last year × mom of 1 year old X time pressure		-0.00491				
		(0.00468)				
workplace last year × mom of 1 year old X contact others			0.00711			
			(0.00652)			
workplace last year × mom of 1 year old X establish relationship				0.00361		
				(0.00830)		
workplace last year × mom of 1 year old X structured workplace					0.00663	
					(0.00566)	
workplace last year × mom of 1 year old X freedom making decisions						0.00288
						(0.00462)
Observations	344,109	344,109	344,109	344,109	344,109	344,109
R-squared	0.026	0.025	0.024	0.025	0.025	0.025
	Panel I: Dependent variable = full time last year, if employed					
workplace last year × mom of 1 year old	0.0375**	0.0435**	0.0426**	0.0333*	0.0385**	0.0400**

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Table A18 – Continued

	(1)	(2)	(3)	(4)	(5)	(6)
	(0.0177)	(0.0169)	(0.0165)	(0.0183)	(0.0179)	(0.0174)
workplace last year X mom of 1 year old X non-flexible	0.00964					
	(0.00657)					
workplace last year × mom of 1 year old X time pressure		0.00554				
		(0.0103)				
workplace last year × mom of 1 year old X contact others			-0.00382			
			(0.00786)			
workplace last year × mom of 1 year old X establish relationship				0.0192***		
				(0.00572)		
workplace last year × mom of 1 year old X structured workplace					0.00728	
					(0.00613)	
workplace last year × mom of 1 year old X freedom making decisions						0.00395
						(0.00586)
Observations	339,029	339,029	339,029	339,029	339,029	339,029
R-squared	0.129	0.132	0.127	0.127	0.128	0.128
	Panel H: Dependent variable = log real hourly wage last year					
workplace last year × mom of 1 year old	0.0379***	0.0380***	0.0447***	0.0321***	0.0369***	0.0438***
	(0.00929)	(0.0123)	(0.0114)	(0.00728)	(0.00862)	(0.0105)
workplace last year X mom of 1 year old X non-flexible	0.00496					
	(0.0120)					
workplace last year × mom of 1 year old X time pressure		0.0161				
		(0.0119)				
workplace last year × mom of 1 year old X contact others			-0.00425			
			(0.00670)			
workplace last year × mom of 1 year old X establish relationship				-0.0124		
				(0.0160)		
workplace last year × mom of 1 year old X structured workplace					0.00438	
					(0.0144)	
workplace last year × mom of 1 year old X freedom making decisions						0.0224**
						(0.0107)
Observations	314,880	314,880	314,880	314,880	314,880	314,880
R-squared	0.349	0.338	0.339	0.346	0.350	0.347

Notes: *** p<0.01, ** p<0.05, * p<0.1.

Table A19: Alternative Channels for the Effects of Workplace Breastfeeding Benefits

	(1)	(2)	(3)	(4)	(5)
	Panel A: Dependent variable = in labor force				
workplace × mom of infants	0.0113*	0.0313***	0.0141*	0.00549	0.00978***
	(0.00585)	(0.00819)	(0.00707)	(0.00355)	(0.00298)
workplace × mom of infants ×# childcare occ	0.203				
	(0.649)				
workplace × mom of infants ×# childcare ind		-1.848**			
		(0.795)			
workplace × mom of infants ×# firm size>99			-0.0137*		
			(0.00766)		
workplace × mom of infants ×# more than 1 employer				-0.00194	
				(0.00771)	
workplace × mom of infants ×# central city					0.00507
					(0.00642)
Observations	369,529	369,529	301,907	346,456	305,454
R-squared	0.912	0.912	0.831	0.828	0.914
	Panel B: Dependent variable = employed, if in labor force				
workplace × mom of infants	-0.0381***	-0.00746	0.00146	0.00445	0.000439
	(0.0112)	(0.0132)	(0.00754)	(0.00659)	(0.00507)
workplace × mom of infants ×# childcare occ	4.325***				
	(1.014)				
workplace × mom of infants ×# childcare ind		0.557			
		(1.280)			
workplace × mom of infants ×# firm size>99			0.00590		
			(0.00546)		
workplace × mom of infants ×# more than 1 employer				-0.0265*	
				(0.0151)	
workplace × mom of infants ×# central city					-0.0185*
					(0.00999)
Observations	341,116	341,116	293,623	336,843	281,560
R-squared	0.052	0.052	0.038	0.044	0.052
	Panel C: Dependent variable = worked in the reference week, if employed				
workplace × mom of infants	0.0184	0.00771	-0.0149	-0.000856	-0.00138

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Table A19 – Continued

	(1)	(2)	(3)	(4)	(5)
	(0.0155)	(0.0265)	(0.0133)	(0.00717)	(0.00727)
workplace × mom of infants ×# childcare occ	-2.240				
	(1.577)				
workplace × mom of infants ×# childcare ind		-0.803			
		(2.252)			
workplace × mom of infants ×# firm size>99			0.0226		
			(0.0220)		
workplace × mom of infants ×# more than 1 employer				0.0100	
				(0.0187)	
workplace × mom of infants ×# central city					0.000683
					(0.0153)
Observations	326,560	326,560	283,897	324,148	269,420
R-squared	0.040	0.040	0.042	0.040	0.041
	Panel D: Dependent variable =log hours worked in the reference week, if worked				
workplace × mom of infants	0.0777	0.0455	0.0388	0.0435***	0.0493**
	(0.0608)	(0.0488)	(0.0264)	(0.0159)	(0.0223)
workplace × mom of infants ×# childcare occ	-3.274				
	(7.206)				
workplace × mom of infants ×# childcare ind		0.404			
		(4.112)			
workplace × mom of infants ×# firm size>99			0.00117		
			(0.0288)		
workplace × mom of infants ×# more than 1 employer				0.0115	
				(0.0612)	
workplace × mom of infants ×# central city					-0.0135
					(0.0262)
Observations	316,077	316,077	274,785	313,873	260,846
R-squared	0.083	0.083	0.083	0.080	0.083
	Panel E: Dependent variable = part time (less than 35h) in the reference week, if worked				
workplace × mom of infants	-0.0760**	-0.0615**	-0.0301	-0.0426***	-0.0474***
	(0.0328)	(0.0281)	(0.0195)	(0.0132)	(0.0171)
workplace × mom of infants ×# childcare occ	3.513				
	(3.628)				
workplace × mom of infants ×# childcare ind		1.374			
		(2.319)			
workplace × mom of infants ×# firm size>99			-0.0162		
			(0.0196)		

Continued on Next Page...

Table A19 – Continued

	(1)	(2)	(3)	(4)	(5)
workplace × mom of infants ×# more than 1 employer				-0.0196	
				(0.0409)	
workplace × mom of infants ×# central city					0.0218
					(0.0328)
Observations	316,077	316,077	274,785	313,873	260,846
R-squared	0.072	0.072	0.070	0.070	0.072
	Panel F: Dependent variable = paid by hour in the reference week, if worked				
workplace × mom of infants	-0.0420**	-0.00600	-0.0129	-0.0138*	-0.0119
	(0.0203)	(0.0265)	(0.00832)	(0.00756)	(0.00827)
workplace × mom of infants ×# childcare occ	3.727*				
	(2.025)				
workplace × mom of infants ×# childcare ind		-0.425			
		(2.334)			
workplace × mom of infants ×# firm size>99			-0.000256		
			(0.00974)		
workplace × mom of infants ×# more than 1 employer				0.0223	
				(0.0414)	
workplace × mom of infants ×# central city					0.00908
					(0.0190)
Observations	316,077	316,077	274,785	313,873	260,846
R-squared	0.039	0.039	0.042	0.039	0.039
	Panel G: Dependent variable = log real hourly wage, if paid by hour in the reference week				
workplace × mom of infants	-0.0583	-0.0688	0.0480	0.0458	0.0947***
	(0.112)	(0.154)	(0.0566)	(0.0401)	(0.0300)
workplace × mom of infants ×# childcare occ	14.88				
	(10.16)				
workplace × mom of infants ×# childcare ind		12.74			
		(12.41)			
workplace × mom of infants ×# firm size>99			-0.00459		
			(0.0638)		
workplace × mom of infants ×# more than 1 employer				0.170	
				(0.170)	
workplace × mom of infants ×# central city					-0.0517
					(0.0816)
Observations	29,781	29,781	25,100	29,529	24,468
R-squared	0.348	0.348	0.356	0.352	0.352

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Table A19 – Continued

	(1)	(2)	(3)	(4)	(5)
	Panel H: Dependent variable = employed last year, unconditional				
workplace last year × mom of 1 year old	-0.0289**	-0.0253	0	0	-0.0173***
	(0.0110)	(0.0157)	(0)	(0)	(0.00463)
workplace last year × mom of 1 year old × # childcare occ	1.032				
	(1.364)				
workplace last year × mom of 1 year old × # childcare ind		0.376			
		(1.382)			
workplace last year × mom of 1 year old × central city					-0.00103
					(0.0102)
Observations	370,671	370,671	301,110	345,880	306,426
R-squared	0.585	0.585			0.590
	Panel I: Dependent variable = full time last year, if employed				
workplace last year × mom of 1 year old	0.109***	0.0632*	0.0299	0.0421***	0.0523***
	(0.0401)	(0.0346)	(0.0212)	(0.0152)	(0.0187)
workplace last year × mom of 1 year old × # childcare occ	-8.010*				
	(4.102)				
workplace last year × mom of 1 year old × # childcare ind		-1.954			
		(3.383)			
workplace last year × mom of 1 year old × firm size ¿99			0.0220		
			(0.0183)		
workplace last year × mom of 1 year old × more than 1 employer				0.00462	
				(0.0227)	
workplace last year × mom of 1 year old × central city					-0.0287
					(0.0229)
Observations	345,880	345,880	301,110	345,880	285,414
R-squared	0.145	0.145	0.163	0.146	0.144
	Panel J: Dependent variable = log real hourly wage last year				
workplace last year × mom of 1 year old	0.0858**	0.0895**	0.0737**	0.0460***	0.0393***
	(0.0334)	(0.0348)	(0.0314)	(0.0153)	(0.0131)
workplace last year × mom of 1 year old × # childcare occ	-4.923				
	(3.287)				
workplace last year × mom of 1 year old × # childcare ind		-4.234			
		(2.721)			
workplace last year × mom of 1 year old × firm size ¿99			-0.0450		
			(0.0344)		
workplace last year × mom of 1 year old × more than 1 employer				0.0239	

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Table A19 – Continued

	(1)	(2)	(3)	(4)	(5)
				(0.0568)	
workplace last year × mom of 1 year old × central city					-0.00908
					(0.0203)
Observations	321,120	321,120	277,582	321,120	264,748
R-squared	0.336	0.336	0.352	0.342	0.341

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

A.3 ADDITIONAL TABLES

Table A20: Years of Other State Laws on Breastfeeding

State Name	Any Place	Jury	Indecency
ALABAMA	2006		
ALASKA	1998		
ARIZONA	2006		2005
ARKANSAS	2007		2007
CALIFORNIA	1997	2000	
COLORADO	2004		
CONNECTICUT	1997	2012*	
DELAWARE	1997		
DISTRICT OF COLUMBIA	2007		2007
FLORIDA	1993		1993
GEORGIA	1999		
HAWAII	2000		
IDAHO		2002	
ILLINOIS	2004	2006	1995
INDIANA	2003		
IOWA	2002	1994	
KANSAS	2006	2006	
KENTUCKY	2006	2007	
LOUISIANA	2001		

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Table A20 – Continued

State Name	Any Place	Jury	Indecency
MAINE	2001		
MARYLAND	2003		
MASSACHUSETTS	2008		2008
MICHIGAN		2012*	1994
MINNESOTA	1998	1998	1998
MISSISSIPPI	2006	2006	2006
MISSOURI	1999	2014*	1999
MONTANA	1999	2009	1999
NEBRASKA	2011*	2003	
NEVADA	1995		1995
NEW HAMPSHIRE			1999
NEW JERSEY	1997		
NEW MEXICO	1999		
NEW YORK	1994		2002
NORTH CAROLINA	1993		1993
NORTH DAKOTA	2009		2009
OHIO	2005		
OKLAHOMA	2004	2004	2004
OREGON	1999	1999	
PENNSYLVANIA	2007		2007
RHODE ISLAND	2008		1998
SOUTH CAROLINA	2005		2005
SOUTH DAKOTA		2012	2002

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Table A20 – Continued

State Name	Any Place	Jury	Indecency
TENNESSEE	2006		2006
TEXAS	1995		
UTAH	1995		1995
VERMONT	2002		
VIRGINIA	2002	2005	1994
WASHINGTON	2009		2001
WEST VIRGINIA	2014*		
WISCONSIN	2009		1995
WYOMING	2007		2007

Notes: * denotes years later than 2010, and in this paper's data sample these states are considered without the law. Column (1) is the "Any place" law, which summarizes the state laws that allow women to breastfeed in any public and private place. Column (2) is the "Jury" exemption law, which exempts nursing women from jury duty. Column (3) is the "Indecency" exemption law, which allows breastfeeding in public to be exempted from public indecency laws.

Table A21: Alternative Control Group: Females without children

	(1) All	(2) Single	(3) Married	(4) Married
	Dependent variable = in labor force			
Law X mom of infant child (control=females without children)	0.00255**	0.00126	0.00156	0.000747
	(0.00110)	(0.00186)	(0.00106)	(0.000986)
Spouse characteristics				Y
Observations	911,349	430,754	480,595	404,169
R-squared	0.892	0.875	0.919	0.918
	Dependent variable = employed, if in labor force			
Law X mom of infant child (control=females without children)	-0.00257	-0.00473	-0.00176	-0.00302
	(0.00376)	(0.00456)	(0.00323)	(0.00349)
Spouse characteristics				Y
Observations	774,636	329,606	445,030	379,064
R-squared	0.103	0.128	0.053	0.051
	Dependent variable = at work, if employed			
Law X mom of infant child (control=females without children)	-0.00129	-0.00208	-0.00166	-0.00239
	(0.00232)	(0.00326)	(0.00201)	(0.00259)
Spouse characteristics				Y
Observations	722,282	298,203	424,079	363,246
R-squared	0.007	0.011	0.005	0.006
	Dependent variable = log hours work, if worked			
Law X mom of infant child (control=females without children)	0.00546	-0.00615	0.0147**	0.0205**
	(0.00358)	(0.00473)	(0.00661)	(0.00838)
Spouse characteristics				Y
Observations	701,774	289,025	412,749	353,807

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Table A21 – Continued

	(1) All	(2) Single	(3) Married	(4) Married
R-squared	0.180	0.218	0.058	0.059
	Dependent variable = part time (less than 35h)			
Law X mom of infant child (control=females without children)	3.71e-05	0.00947	-0.0126***	-0.0173***
	(0.00518)	(0.00604)	(0.00419)	(0.00493)
Spouse characteristics				Y
Observations	701,774	289,025	412,749	353,807
R-squared	0.181	0.229	0.049	0.048
	Dependent variable = hourly paid, if worked			
Law X mom of infant child (control=females without children)	0.00229	0.00587	-0.00173	-0.00152
	(0.00278)	(0.00381)	(0.00458)	(0.00335)
Spouse characteristics				Y
Observations	701,774	289,025	412,749	353,807
R-squared	0.035	0.028	0.035	0.038
	Dependent variable = hourly wage if paid hourly			
Law X mom of infant child (control=females without children)	0.0465***	0.0330***	0.0534***	0.0730***
	(0.0121)	(0.0115)	(0.0138)	(0.0201)
Spouse characteristics				Y
Observations	83,207	41,577	41,630	34,211
R-squared	0.446	0.403	0.365	0.367
	Dependent variable = employed last year (unconditional)			
Law last year X mom of 1-yr-old (control=females without children)	0.00825*	0.0293**	-0.00421	-0.00424
	(0.00458)	(0.0143)	(0.00489)	(0.00508)
Spouse characteristics				Y
Observations	313,060	180,725	132,335	102,864
R-squared	0.531	0.481	0.614	0.625
	Dependent variable = full time last year, if employed			

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Table A21 – Continued

	(1) All	(2) Single	(3) Married	(4) Married
Law last year X mom of 1-yr-old (control=females without children)	0.0422***	0.00710	0.0377**	0.0320**
	(0.0146)	(0.0211)	(0.0146)	(0.0156)
Spouse characteristics				Y
Observations	246,271	141,718	104,553	81,248
R-squared	0.245	0.293	0.129	0.137
	Dependent variable = hourly wage last year			
Law last year X mom of 1-yr-old (control=females without children)	-0.00101	-0.0357*	0.00611	0.0131
	(0.0119)	(0.0202)	(0.0144)	(0.0121)
Spouse characteristics				Y
Observations	237,764	138,263	99,501	77,124
R-squared	0.332	0.304	0.318	0.329

Notes: Standard errors in parentheses and are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1.

Table A22: Robustness: Effects Estimated Without Recession Years

	(1) All	(2) Single	(3) Married	(4) Married + sp cov
	Dependent variable = in labor force			
workplace X mom of infant	0.0137***	0.0155**	0.0156***	0.0134***
	(0.00282)	(0.00675)	(0.00241)	(0.00257)
Observations	541,783	204,132	337,651	293,769
R-squared	0.885	0.866	0.905	0.905
	Dependent variable = employed, if in labor force			
workplace X mom of infant	-0.0142**	-0.0282	-0.00831	-0.00511
	(0.00581)	(0.0187)	(0.00678)	(0.00739)
Observations	469,476	159,403	310,073	271,555
R-squared	0.094	0.111	0.051	0.049
	Dependent variable = at work, if employed			
workplace X mom of infant	0.00742	0.0106	0.00470	0.00197
	(0.0108)	(0.0256)	(0.00860)	(0.00751)
Observations	438,440	142,368	296,072	260,673
R-squared	0.024	0.013	0.034	0.038
	Dependent variable = part time, if worked			
workplace X mom of infant	-0.0268	0.0454	-0.0393***	-0.0393***
	(0.0175)	(0.0316)	(0.0138)	(0.0129)
Observations	424,440	137,943	286,497	252,304
R-squared	0.143	0.192	0.068	0.074
	Dependent variable = log hours worked last week			
workplace X mom of infant	0.0237	-0.0566	0.0362**	0.0456***
	(0.0181)	(0.0358)	(0.0158)	(0.0164)
Observations	424,440	137,943	286,497	252,304
R-squared	0.142	0.181	0.079	0.086
	Dependent variable = hourly paid last week			

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Table A22 – Continued

	(1)	(2)	(3)	(4)
	All	Single	Married	Married + sp cov
workplace X mom of infant	-0.0216***	-0.0296	-0.0206*	-0.0210*
	(0.00701)	(0.0202)	(0.0103)	(0.0114)
Observations	424,440	137,943	286,497	252,304
R-squared	0.035	0.028	0.036	0.039
	Dependent variable =log hourly wage if paid hourly last week			
workplace X mom of infant	0.0350	0.0747	0.0298	0.0348
	(0.0396)	(0.0542)	(0.0427)	(0.0461)
Observations	51,287	20,907	30,380	25,929
R-squared	0.431	0.388	0.342	0.351
	(1)	(3)	(4)	(5)
	Dependent variable = employed last year			
workplace last year X mom of 1 yr old	-0.00981*	0.0182	-0.0186**	-0.0235***
	(0.00562)	(0.0130)	(0.00708)	(0.00618)
Observations	580,321	218,948	361,373	314,401
R-squared	0.506	0.450	0.573	0.583
	Dependent variable = full time last year			
workplace last year X mom of 1 yr old	0.0360	0.0176	0.0365*	0.0366*
	(0.0219)	(0.0253)	(0.0195)	(0.0207)
Observations	516,022	180,304	335,718	294,064
R-squared	0.223	0.225	0.135	0.152
	Dependent variable = hourly wage last year			
workplace last year X mom of 1 yr old	0.0239**	-0.0327	0.0388**	0.0471***
	(0.0119)	(0.0255)	(0.0150)	(0.0139)
Observations	483,509	172,190	311,319	272,602
R-squared	0.361	0.260	0.318	0.336

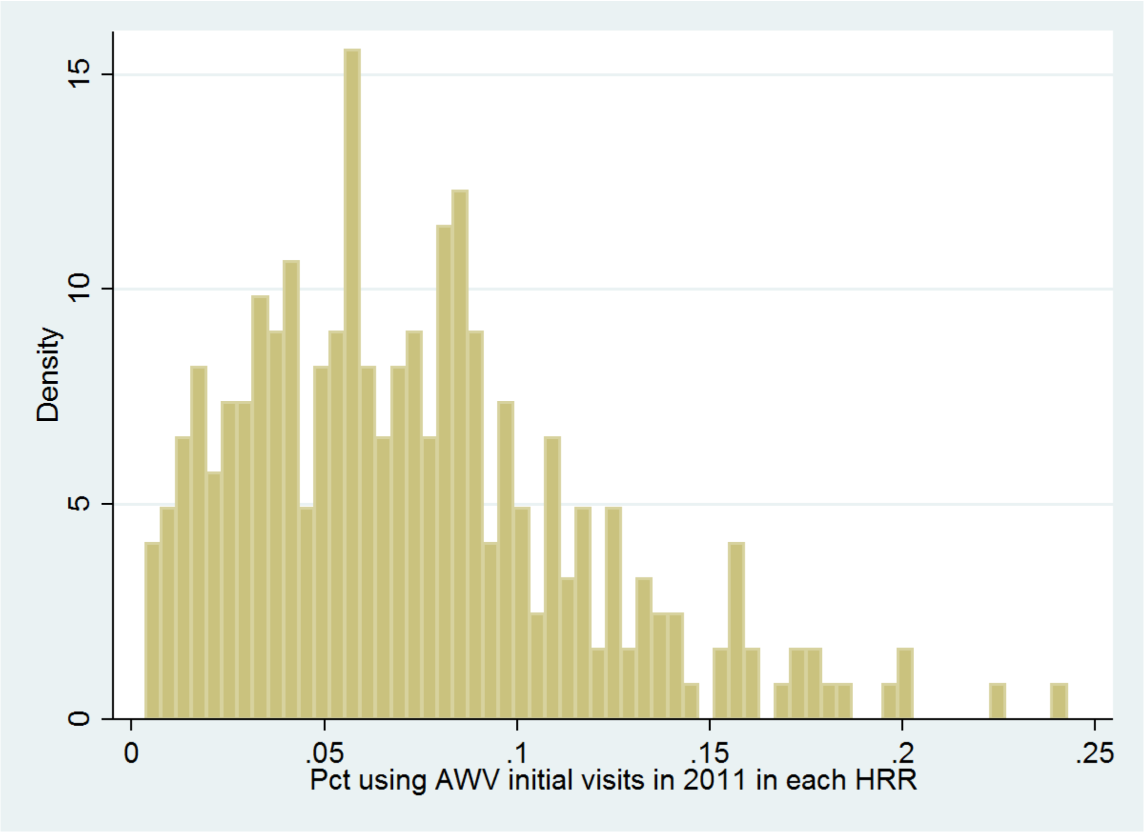
Notes: For the flow outcomes, the years are 1990-2006. For the stock outcomes, the years are 1990-2007. Standard errors in parentheses and are clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1.

APPENDIX B

CHAPTER 2 APPENDIX

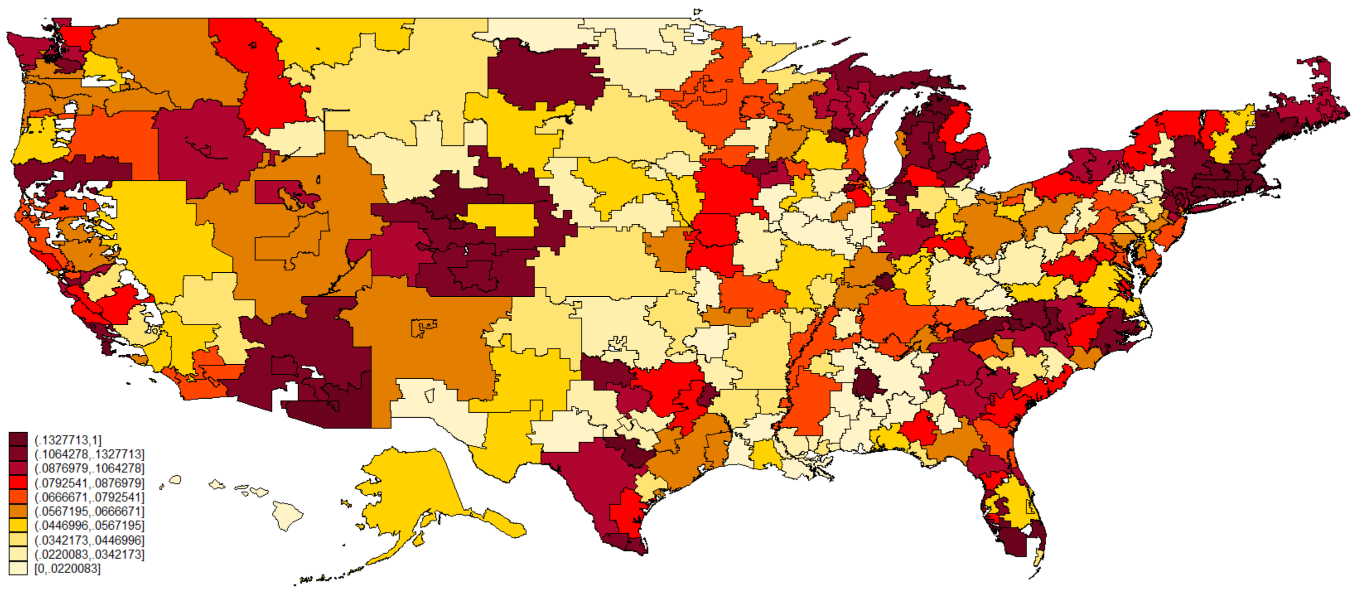
B.1 FIGURES

Figure B1: Variation of the AWV Take-up Rates at HRR Level



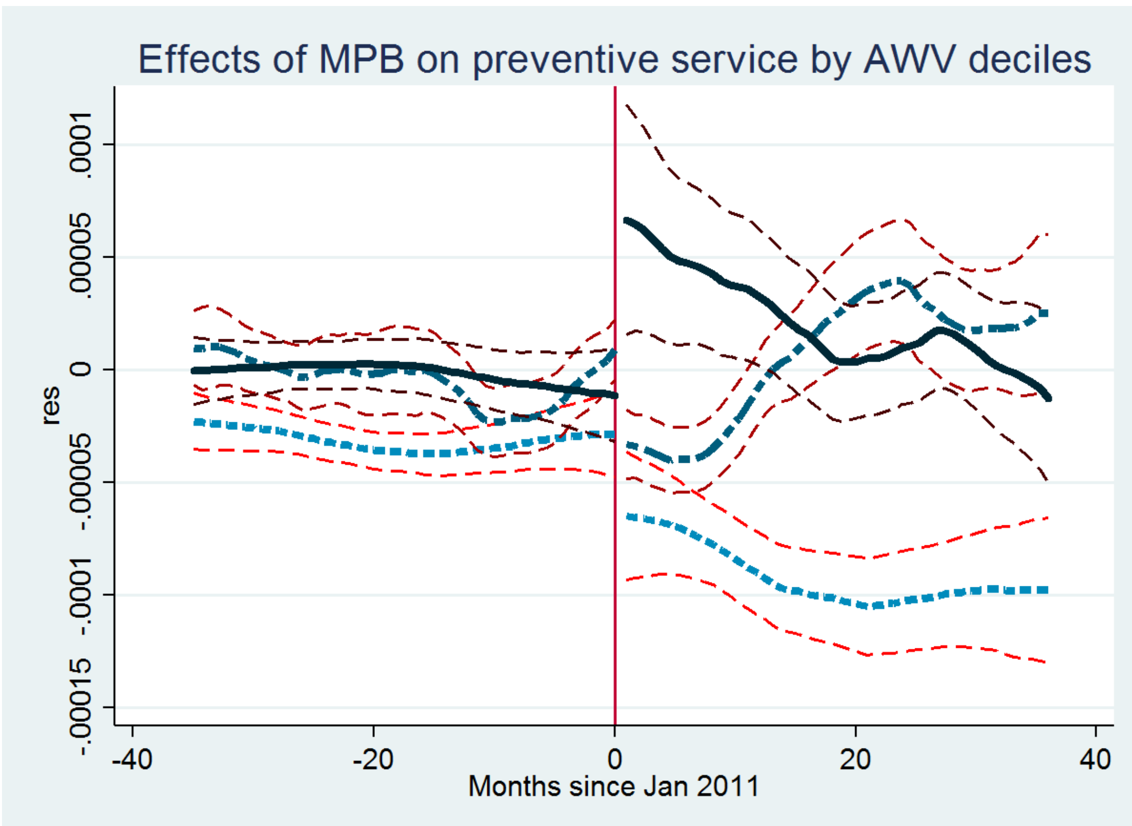
Notes: The sample consists of beneficiaries who are at least 65, have 0 months of HMO, have continuous enrollment of Part A and Part B, and who do not move between HRRs, during 2008-2013. The take-up rate of AWV is defined as the percentage of beneficiaries in each HRR who used the initial Annual Wellness Visit Service during 2011. The number of observations is 306. The mean is 0.07262; the standard deviation is 0.043999; the min is 0.003531 and the max is 0.242652.

Figure B2: Distribution of the AWV Take-up Rates at HRR Level



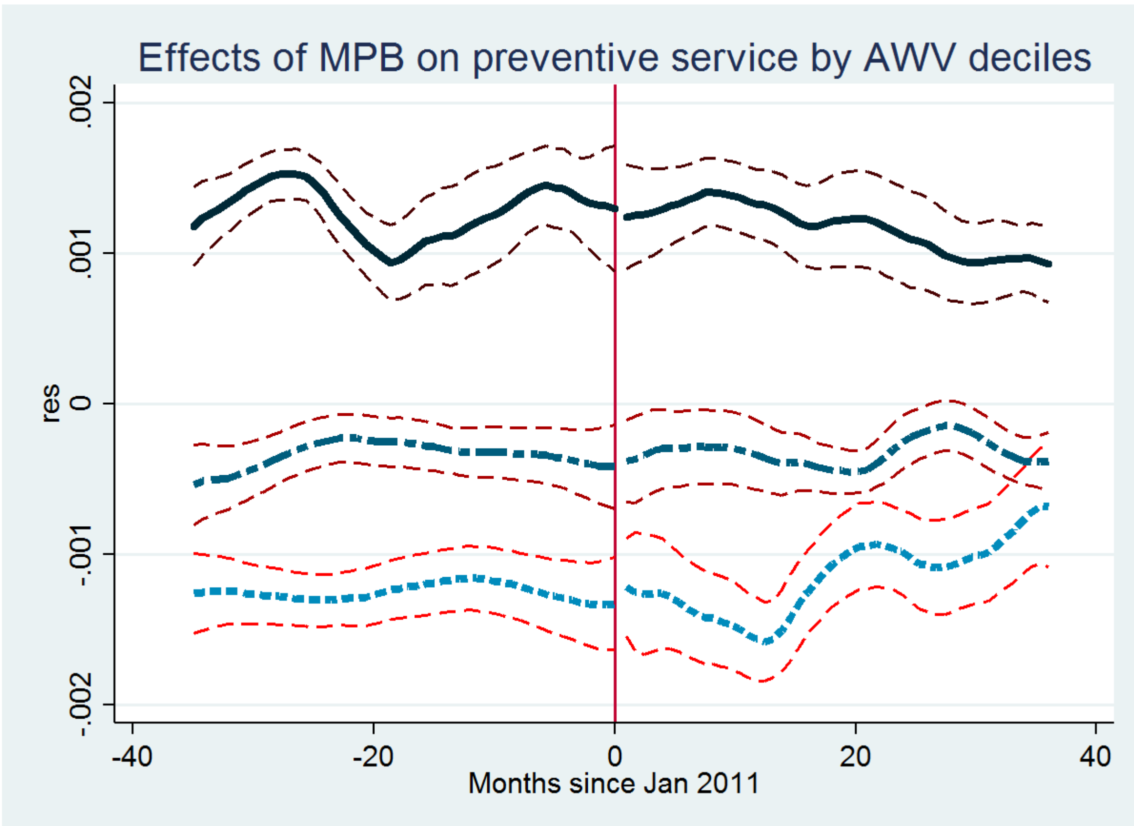
Notes: The sample consists of beneficiaries who are at least 65, have 0 months of HMO, have continuous enrollment of Part A and Part B, and who do not move between HRRs, during 2008-2013. The take-up rate of AWV is defined as the percentage of beneficiaries in each HRR who used the initial Annual Wellness Visit Service during 2011. The geographical information is from the Dartmouth Atlas of Health Care.

Figure B3: Effects of Removing Costs on Usage of Abdominal Aortic Aneurysm (AAA) Screening



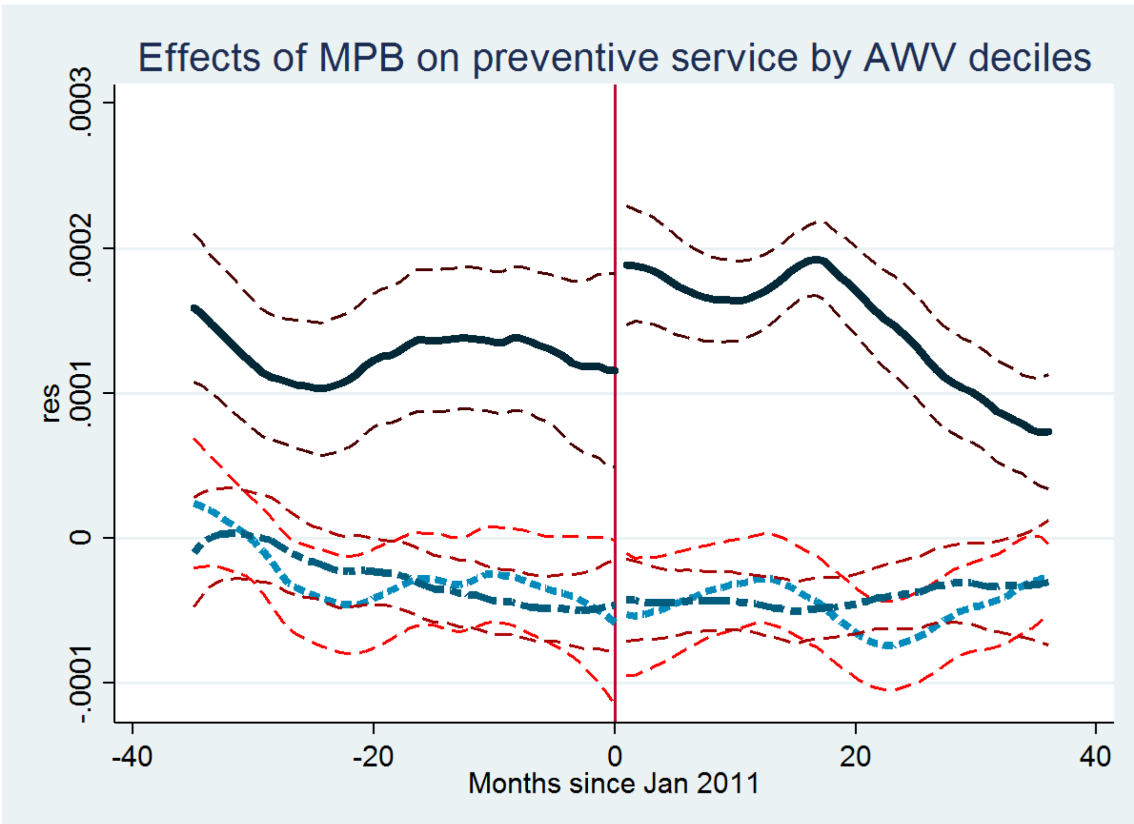
Notes: The figure plots an event-study of the usage of AAA among all non-movers who live in the 1st, 5th, and 10th decile of the AWV take-up rate at HRR distribution. The y-axis plots the residual of a regression of the usage of AAA on the gender, race categories, birth year fixed effects, and monthly dummies.

Figure B4: Effects of Removing Costs on Usage of Bone Mass Measurement



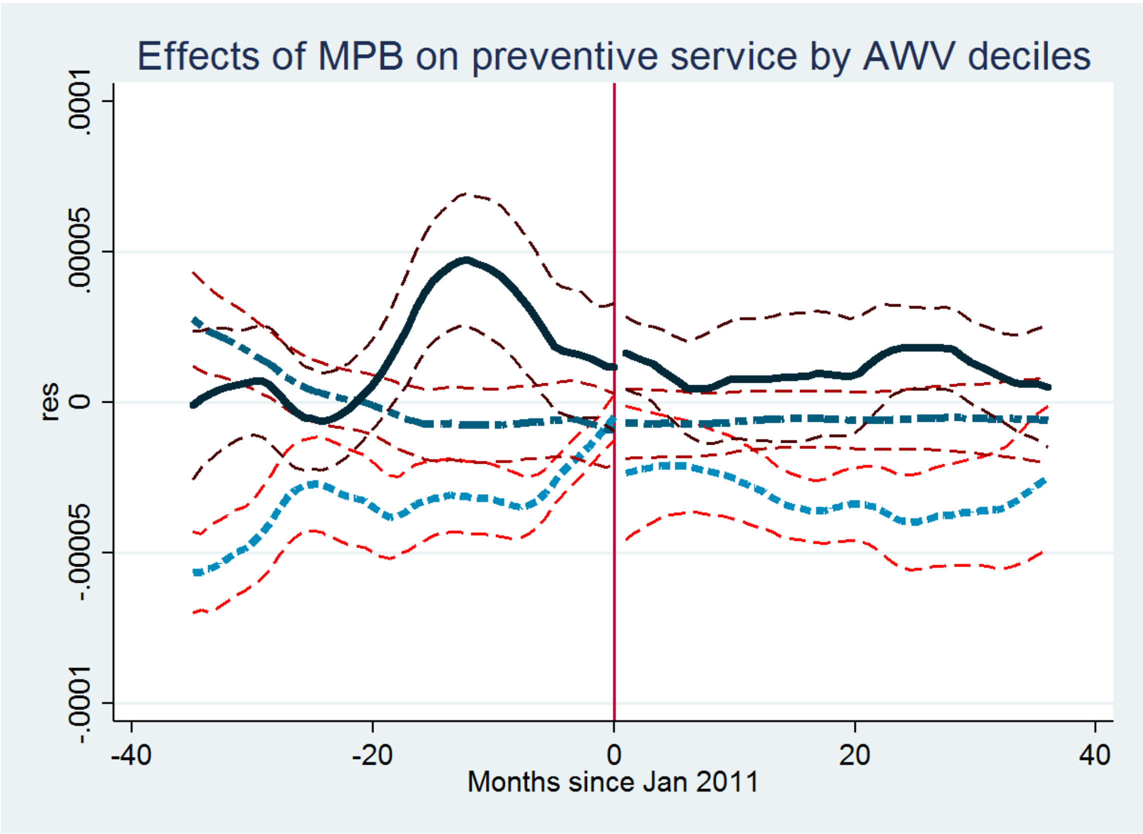
Notes: The figure plots an event-study of the usage of bone mass measurement among all non-movers who live in the 1st, 5th, and 10th decile of the AWV take-up rate at HRR distribution. The y-axis plots the residual of a regression of the usage of bone mass measurement on the gender, race categories, birth year fixed effects, and monthly dummies.

Figure B5: Effects of Removing Costs on Usage of Medical Nutritional Therapy



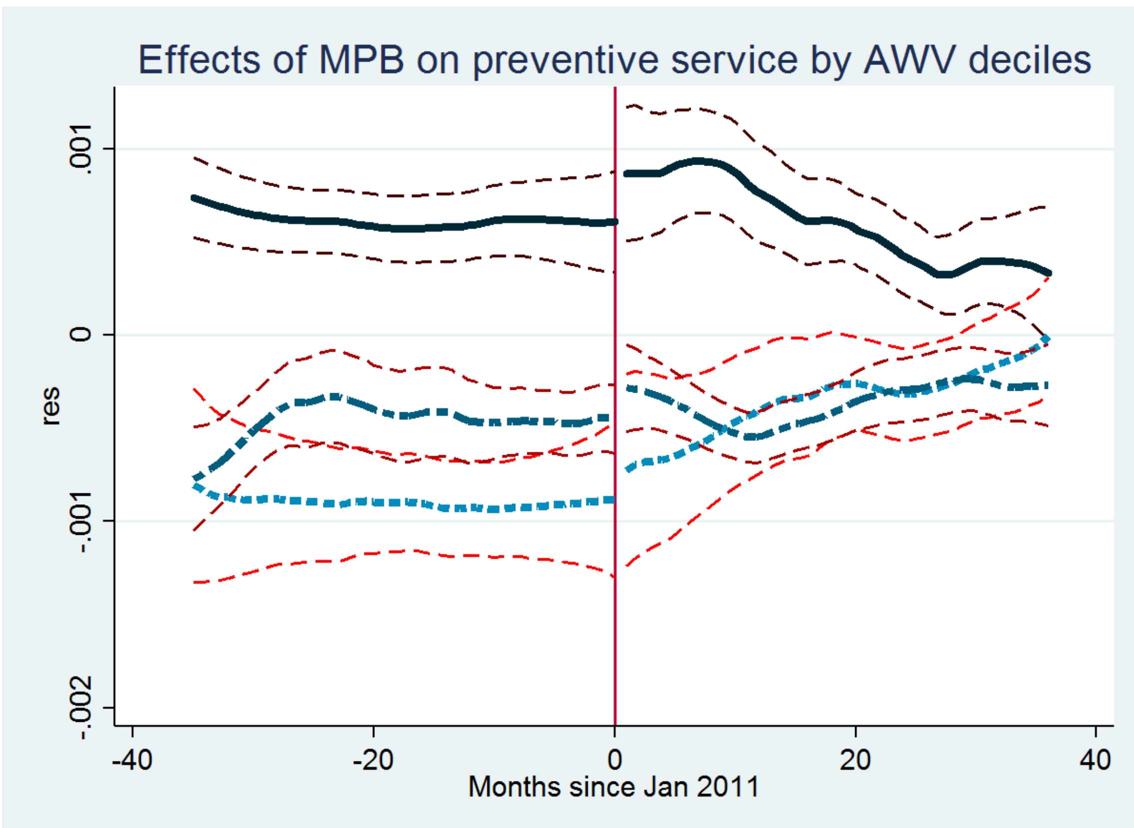
Notes: The figure plots an event-study of the usage of bone mass measurement among all non-movers who live in the 1st, 5th, and 10th decile of the AWV take-up rate at HRR distribution. The y-axis plots the residual of a regression of the usage of medical nutritional therapy on the gender, race categories, birth year fixed effects, and monthly dummies.

Figure B6: Effects of Removing Costs on Usage of Hepatitis B Vaccine



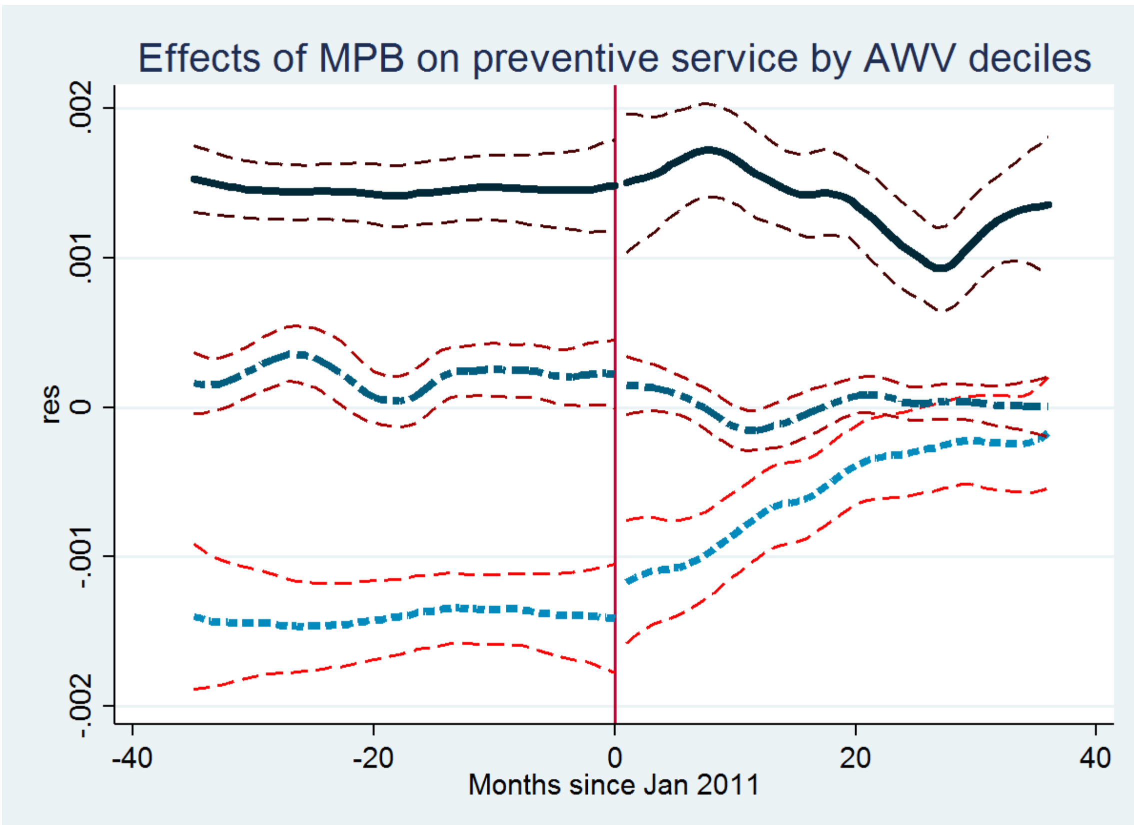
Notes: The figure plots an event-study of the usage of bone mass measurement among all non-movers who live in the 1st, 5th, and 10th decile of the AWV take-up rate at HRR distribution. The y-axis plots the residual of a regression of the usage of Hepatitis B vaccine on the gender, race categories, birth year fixed effects, and monthly dummies.

Figure B7: Effects of Removing Costs on Usage of Pap Tests



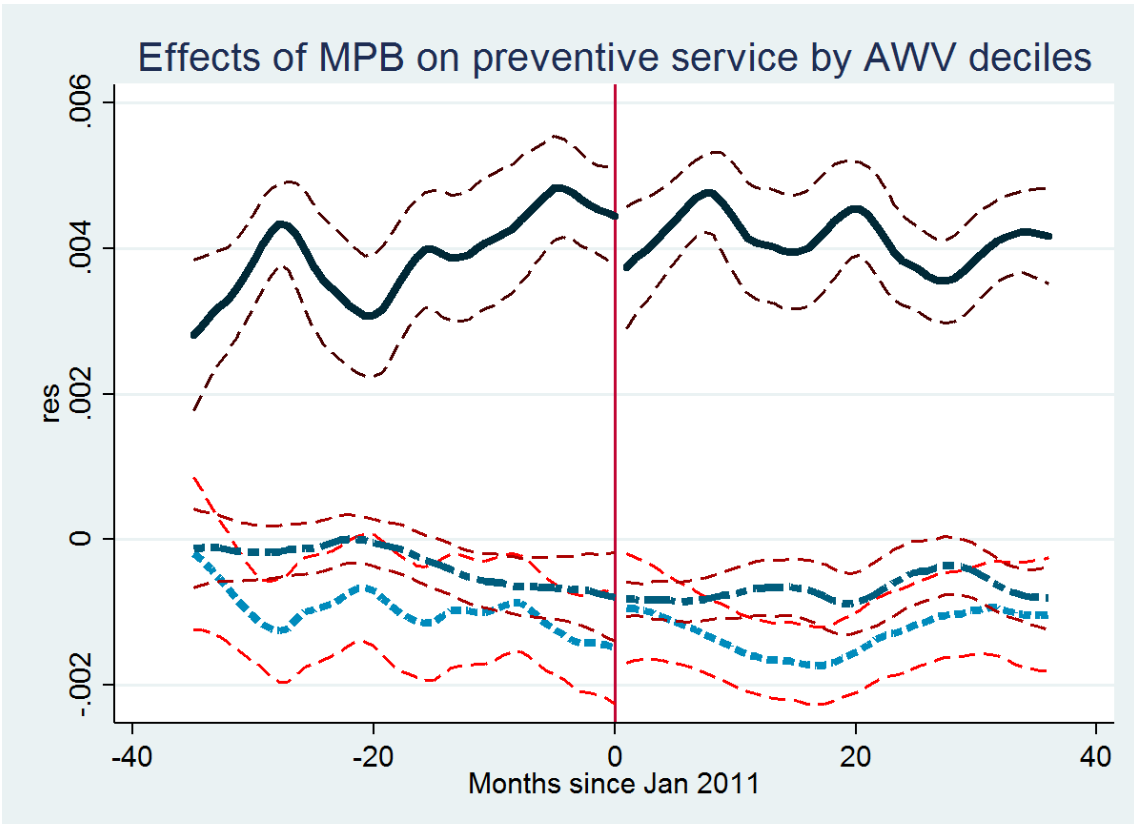
Notes: The figure plots an event-study of the usage of bone mass measurement among all non-movers who live in the 1st, 5th, and 10th decile of the AWV take-up rate at HRR distribution. The y-axis plots the residual of a regression of the usage of pap test on race categories, birth year fixed effects, and monthly dummies.

Figure B8: Effects of Removing Costs on Usage of Pelvic Tests



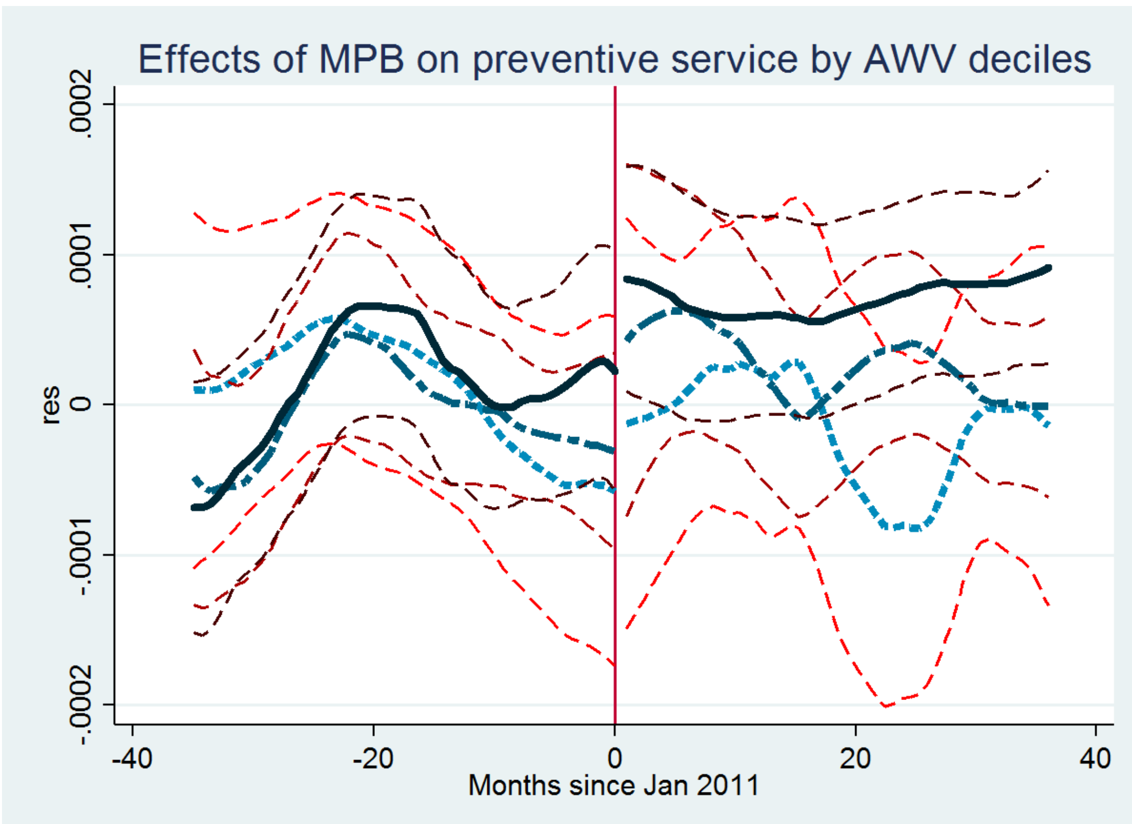
Notes: The figure plots an event-study of the usage of bone mass measurement among all non-movers who live in the 1st, 5th, and 10th decile of the AWV take-up rate at HRR distribution. The y-axis plots the residual of a regression of the usage of pelvic test on race categories, birth year fixed effects, and monthly dummies.

Figure B9: Effects of removing costs on usage of Screening Mammography



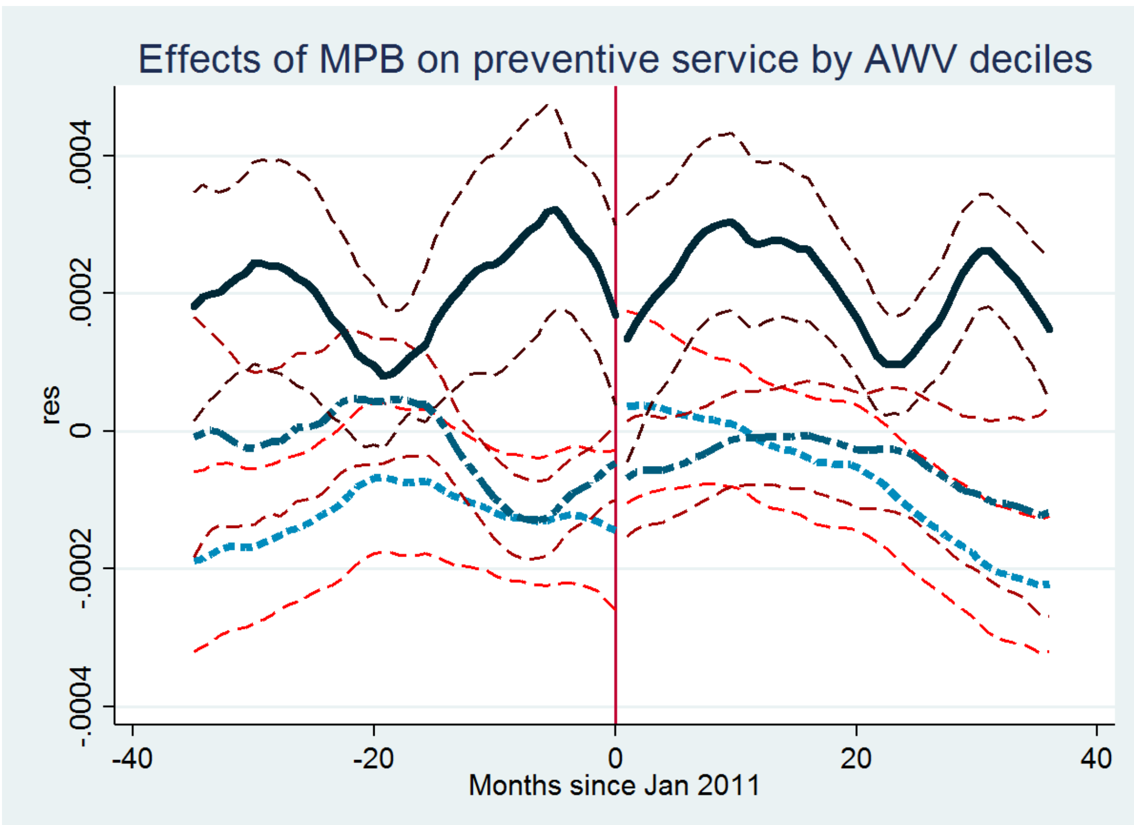
Notes: The figure plots an event-study of the usage of bone mass measurement among all non-movers who live in the 1st, 5th, and 10th decile of the AWV take-up rate at HRR distribution. The y-axis plots the residual of a regression of the usage of screening Mammography on race categories, birth year fixed effects, and monthly dummies.

Figure B10: Effects of Removing Costs on Usage of Colonoscopy by Beneficiaries with Low Risks of Colorectal Cancer for Colorectal Screening



Notes: The figure plots an event-study of the usage of bone mass measurement among all non-movers who live in the 1st, 5th, and 10th decile of the AWV take-up rate at HRR distribution. The y-axis plots the residual of a regression of the usage of screening colonoscopy (low risk of colorectal cancer) on race categories, birth year fixed effects, and monthly dummies.

Figure B11: Effects of removing costs on usage of colonoscopy by beneficiaries with high risks of colorectal cancer for colorectal screening



Notes: The figure plots an event-study of the usage of bone mass measurement among all non-movers who live in the 1st, 5th, and 10th decile of the AWV take-up rate at HRR distribution. The y-axis plots the residual of a regression of the usage of screening colonoscopy (high risk of colorectal cancer)on race categories, birth year fixed effects, and monthly dummies.

B.2 TABLES

Table B1: Summary Statistics of Non-Movers (same HRR during 2008-2013)

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
#beneficiaries in each HRR	801,752	4,881	3,659	369	15,428
Year of birth	801,752	1,933	6.794	1,868	1,946
Male	801,752	0.374	0.484	0	1
Female	801,752	0.626	0.484	0	1
Race unknown	801,752	0.000819	0.0286	0	1
White	801,752	0.887	0.317	0	1
Black	801,752	0.0670	0.250	0	1
Other	801,752	0.0135	0.115	0	1
Asian	801,752	0.0150	0.121	0	1
Hispanic	801,752	0.0128	0.112	0	1
North American natives	801,752	0.00409	0.0638	0	1

Notes: The sample consists of all fee-for-services Medicare beneficiaries who are at least 65, have 0 months of HMO, and have continuous enrollment of Part A and Part B during 2008-2013; in addition, the beneficiaries stay in the same HRR during 2008-2013.

Table B2: Summary Statistics of Movers (Same HRR in 2011-2012, and Another HRR in 2013)

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Initial AWV IN 2011	15,225	0.0756	0.264	0	1
Initial AWV IN 2012	15,225	0.0598	0.237	0	1
Initial AWV IN 2013	15,225	0.0756	0.264	0	1
Initial or subsequent AWV in 2011	15,225	0.0884	0.284	0	1
Initial or subsequent AWV in 2012	15,225	0.114	0.318	0	1
Initial or subsequent AWV in 2013	15,225	0.134	0.340	0	1
Change of AWV use during 2012-2013	15,225	0.0191	0.359	-1	1
Change of decile during 2012-2013	15,225	0.130	3.337	-9	9
Year of birth	15,225	1,932	7.139	1,892	1,943
Male	15,225	0.347	0.476	0	1
Female	15,225	0.653	0.476	0	1
Race unknown	15,225	0.000920	0.0303	0	1
White	15,225	0.910	0.286	0	1
Black	15,225	0.0497	0.217	0	1
Other	15,225	0.0103	0.101	0	1
Asian	15,225	0.0118	0.108	0	1
Hispanic	15,225	0.0128	0.112	0	1
North American natives	15,225	0.00460	0.0677	0	1

Notes: The sample consists of all fee-for-services Medicare beneficiaries who are at least 65, have 0 months of HMO, and have continuous enrollment of Part A and Part B during 2008-2013; in addition, the beneficiaries stay in the same HRR during 2011 and 2012, but move to a different HRR in 2013. The decile of the AWV take-up rates is assigned to HRRs.

Table B3: Effects of HRR Level Take-up Rates on Usage of “Annual Wellness Visits”

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VAR	Δ use	Δ use	Δ use	awv12	awv12	awv12	awv13	awv13	awv13
Δ Decile	0.000785	0.00362**	0.00371**	-0.00436***	0.00670***	0.00641***	-0.00357***	0.0103***	0.0101***
	(0.000871)	(0.00168)	(0.00168)	(0.000759)	(0.00151)	(0.00151)	(0.000805)	(0.00160)	(0.00159)
2012 Decile:									
2nd		0.0141	0.0130		0.0294**	0.0325***		0.0436***	0.0455***
		(0.0135)	(0.0136)		(0.0115)	(0.0115)		(0.0124)	(0.0125)
3rd		0.0167	0.0164		0.0414***	0.0455***		0.0581***	0.0620***
		(0.0127)	(0.0128)		(0.0107)	(0.0108)		(0.0115)	(0.0116)
4th		0.0300***	0.0295**		0.0538***	0.0574***		0.0838***	0.0869***
		(0.0114)	(0.0115)		(0.01000)	(0.0101)		(0.0108)	(0.0109)
5th		0.0352***	0.0350***		0.0791***	0.0817***		0.114***	0.117***
		(0.0129)	(0.0130)		(0.0113)	(0.0113)		(0.0122)	(0.0123)
6th		0.0260**	0.0256**		0.0839***	0.0855***		0.110***	0.111***
		(0.0129)	(0.0130)		(0.0116)	(0.0116)		(0.0124)	(0.0125)
7th		0.0274*	0.0268*		0.112***	0.112***		0.139***	0.139***
		(0.0145)	(0.0146)		(0.0133)	(0.0133)		(0.0139)	(0.0140)
8th		0.0356**	0.0352**		0.130***	0.133***		0.166***	0.168***
		(0.0155)	(0.0156)		(0.0140)	(0.0140)		(0.0150)	(0.0151)
9th		0.0459***	0.0466***		0.138***	0.137***		0.184***	0.184***
		(0.0168)	(0.0169)		(0.0152)	(0.0152)		(0.0161)	(0.0162)
10th		0.0476***	0.0491***		0.209***	0.209***		0.257***	0.259***
		(0.0176)	(0.0177)		(0.0162)	(0.0163)		(0.0173)	(0.0173)
2013 Decile:									
2nd		0.0134	0.0150		-0.0166	-0.0192		-0.00318	-0.00427
		(0.0151)	(0.0151)		(0.0128)	(0.0127)		(0.0139)	(0.0139)
3rd		-0.00324	-0.00270		0.00464	0.00565		0.00141	0.00295
		(0.0137)	(0.0137)		(0.0122)	(0.0122)		(0.0128)	(0.0128)
4th		-0.0115	-0.0111		0.00920	0.00886		-0.00231	-0.00224
		(0.0117)	(0.0117)		(0.0105)	(0.0105)		(0.0109)	(0.0109)
5th		0.00304	0.00326		-0.0105	-0.0104		-0.00746	-0.00710
		(0.0112)	(0.0112)		(0.00987)	(0.00987)		(0.0107)	(0.0107)
6th		-0.0106	-0.0105		-0.000625	0.00131		-0.0112	-0.00923

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Table B3 – Continued

VAR	(1) Δ use	(2) Δ use	(3) Δ use	(4) awv12	(5) awv12	(6) awv12	(7) awv13	(8) awv13	(9) awv13
		(0.0107)	(0.0108)		(0.00964)	(0.00962)		(0.0102)	(0.0102)
7th		-0.00197	-0.00231		-0.000367	1.68e-06		-0.00234	-0.00230
		(0.0116)	(0.0117)		(0.0102)	(0.0102)		(0.0111)	(0.0111)
8th		-0.0358***	-0.0359***		-0.000491	0.00122		-0.0363***	-0.0347***
		(0.0115)	(0.0115)		(0.0104)	(0.0104)		(0.0108)	(0.0108)
9th		-0.00797	-0.00747		-0.0216**	-0.0204*		-0.0296**	-0.0278**
		(0.0124)	(0.0124)		(0.0109)	(0.0108)		(0.0118)	(0.0118)
Cov			Y			Y			Y
Obs	15,225	15,225	15,225	15,225	15,225	15,225	15,225	15,225	15,225
R-sq	0.000	0.002	0.004	0.002	0.021	0.028	0.001	0.023	0.029

Notes: The sample consists of beneficiaries who lives in the same HRR in 2011 and 2012, but moves to a different HRR in 2013. The variable "change of AWV use" denotes the dummy variable of AWV use in 2013 minus dummy variable of AWV use in 2012. $\Delta Decile_i$ denotes the decile of AWV rate in the destination HRR (in 2013) minus the decile in the origin HRR (in 2012). The "2012 Deciles" and "2013 Deciles" are the origin and destination fixed effects, respectively (note that the omitted category is living in the first decile in 2012). The vector of individual covariates includes gender, race categories (White, Black, Asian, Hispanics, North American natives, other races, and the omitted category is the unknown), and year-of-birth fixed effects.

Table B4: Summary Statistics of Usages of Preventive Services Affected by MPB

	(1) Year	(2) Mean	(3) S.D.	(4) Year	(5) Mean	(6) S.D.
Panel A: Copayment/coinsurance waived, deductible waived						
Colonoscopy among average risks	2008	0.00782	0.0881	2011	0.00607	0.0777
	2009	0.00641	0.0798	2012	0.00644	0.0800
	2010	0.00584	0.0762	2013	0.00588	0.0765
Colonocopy among high risks	2008	0.00796	0.0888	2011	0.00919	0.0954
	2009	0.00801	0.0891	2012	0.00896	0.0942
	2010	0.00891	0.0940	2013	0.00824	0.0904
Colotrectal cancer screening, fecal occult blood test	2008	0.0153	0.123	2011	0.0246	0.155
	2009	0.0175	0.131	2012	0.0233	0.151
	2010	0.0215	0.145	2013	0.0222	0.147
Colorectal cancer screening, blood occult	2008	0.0512	0.220	2011	0.0344	0.182
	2009	0.0450	0.207	2012	0.0285	0.166
	2010	0.0410	0.198	2013	0.0245	0.154
Colorectal cancer screening, flexible sigmoidoscopy	2008	0.000125	0.0112	2011	9.35e-05	0.00967
	2009	8.48e-05	0.00921	2012	9.73e-05	0.00986
	2010	9.98e-05	0.00999	2013	7.61e-05	0.00872
Screening mammography	2008	0.223	0.416	2011	0.229	0.42
	2009	0.22	0.414	2012	0.21	0.407
	2010	0.237	0.425	2013	0.196	0.397
Pap test	2008	0.0668	0.25	2011	0.0485	0.215
	2009	0.0593	0.236	2012	0.0369	0.189
	2010	0.0548	0.228	2013	0.0277	0.164
Pelvic test	2008	0.0514	0.221	2011	0.0456	0.209

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Table B4 – Continued

	(1) Year	(2) Mean	(3) S.D.	(4) Year	(5) Mean	(6) S.D.
	2009	0.048	0.214	2012	0.0396	0.195
	2010	0.0489	0.216	2013	0.0346	0.183
AAA (Abdominal aortic aneurysm screening)	2008	0.000510	0.0226	2011	0.0017	0.0411
	2009	0.000615	0.0248	2012	0.00206	0.0453
	2010	0.000854	0.0292	2013	0.0021	0.0458
Bone mass measurement	2008	0.103	0.304	2011	0.103	0.304
	2009	0.101	0.301	2012	0.0908	0.287
	2010	0.108	0.311	2013	0.0841	0.278
Medical nutritional therapy	2008	0.00211	0.0458	2011	0.00248	0.0497
	2009	0.00214	0.0462	2012	0.00257	0.0506
	2010	0.00239	0.0488	2013	0.00256	0.0506
Hepatitis B vaccination	2008	0.000772	0.0278	2011	0.000664	0.0258
	2009	0.000589	0.0243	2012	0.000736	0.0271
	2010	0.000591	0.0243	2013	0.000780	0.0279
Panel B: Copayment/coinsurance applies, but deductible waived						
Colotrectal cancer screening, flexible sigmoidoscopy, Barium Enema	2008	1.62e-05	0.00403	2011	8.73e-06	0.00295
	2009	1.12e-05	0.00335	2012	6.24e-06	0.00250
	2010	9.98e-06	0.00316	2013	2.49e-06	0.00158
Colotrectal cancer screening, screening colonoscopy Barium Enema	2008	7.48e-06	0.00274	2011	4.99e-06	0.00223
	2009	8.73e-06	0.00295	2012	2.49e-06	0.00158
	2010	8.73e-06	0.00295	2013	1.25e-06	0.00112

Notes: The table shows the average usage rates of the preventive services that are affected by the MPB, starting from Jan 1, 2011. The number of the observations is 801,752. The sample consists of all fee-for-services Medicare beneficiaries who are at least 65, have 0 months of HMO, and have continuous enrollment of Part A and Part B during 2008-2013; in addition, the beneficiaries stay in the same HRR during 2008-2013. The definitions of the usages are shown in Appendix C.

Table B5: Summary Statistics of Usages of Preventive Services Not Affected by MPB

	(1) Year	(2) Mean	(3) S.D.	(4) Year	(5) Mean	(6) S.D.
Panel B: Always free						
Flu vaccination	2008	0.406	0.491	2011	0.512	0.500
	2009	0.403	0.490	2012	0.509	0.500
	2010	0.505	0.500	2013	0.513	0.500
Pneumonia shots	2008	0.0478	0.213	2011	0.0414	0.199
	2009	0.0379	0.191	2012	0.0416	0.200
	2010	0.0406	0.197	2013	0.0418	0.200
Cardiovascular disease screening	2008	0.416	0.493	2011	0.451	0.498
	2009	0.416	0.493	2012	0.437	0.496
	2010	0.457	0.498	2013	0.430	0.495
Diabetes screening	2008	0.0484	0.215	2011	0.0416	0.200
	2009	0.0441	0.205	2012	0.0386	0.193
	2010	0.0451	0.208	2013	0.0366	0.188
Panel B: Always have patient costs						
Glaucoma tests	2008	2.37e-05	0.00487	2011	1.87e-05	0.00433
	2009	3.24e-05	0.00569	2012	4.12e-05	0.00642
	2010	2.62e-05	0.00512	2013	3.99e-05	0.00632
Diabetes self management training	2008	0.00143	0.0378	2011	0.00162	0.0402
	2009	0.00151	0.0388	2012	0.00154	0.0392
	2010	0.00158	0.0397	2013	0.00161	0.0400
Prostate cancer screening	2008	0.0606	0.239	2011	0.0511	0.220
	2009	0.0573	0.232	2012	0.0433	0.204
	2010	0.0533	0.225	2013	0.0394	0.195
Colonoscopy for diagnostic purposes	2008	0.0805	0.272	2011	0.0716	0.258
	2009	0.0735	0.261	2012	0.0656	0.248
	2010	0.0764	0.266	2013	0.0613	0.240

Notes: The table shows the average usage rates of the preventive not affected by the MPB. The number of the observations is 801,752. The sample consists of all fee-for-services Medicare beneficiaries who are at least 65, have 0 months of HMO, and have continuous enrollment of Part A and Part B during 2008-2013; in addition, the beneficiaries stay in the same HRR during 2008-2013. The definitions of the usages are shown in Appendix C.

Table B6: Effects of Patient Cost Removal on Usages of Medicare Preventive Services

	(1) All	(2) All	(3) Male	(4) Female	(5) All	(6) All	(7) Male	(8) Female
	AAA screening				Bone mass measurement			
post	0.00159***	0.00105***	0.00105***	0.00103***	-0.0189***	-0.0176***	-0.00265***	-0.0267***
	(0.000153)	(0.000244)	(0.000321)	(0.000246)	(0.000778)	(0.00103)	(0.000611)	(0.00148)
postXawv		0.00715***	0.0151***	0.00250		-0.0165	0.00935*	-0.0309**
		(0.00253)	(0.00357)	(0.00225)		(0.0100)	(0.00538)	(0.0146)
Observations	4,810,512	4,810,512	1,799,202	3,011,310	4,810,512	4,810,512	1,799,202	3,011,310
R-squared	0.182	0.182	0.181	0.182	0.272	0.272	0.285	0.239
	Medical nutritional therapy				Hepatitis B vaccination			
post	0.000459***	0.000350	0.000436	0.000298	7.48e-06	3.40e-05	-4.89e-05	8.32e-05
	(0.000157)	(0.000252)	(0.000324)	(0.000258)	(5.60e-05)	(7.98e-05)	(0.000123)	(9.10e-05)
postXawv		0.00142	0.00167	0.00128		-0.000346	0.000116	-0.000617
		(0.00242)	(0.00305)	(0.00266)		(0.000747)	(0.00124)	(0.000853)
Observations	4,810,512	4,810,512	1,799,202	3,011,310	4,810,512	4,810,512	1,799,202	3,011,310
R-squared	0.277	0.277	0.276	0.278	0.243	0.243	0.237	0.248
	Screening mammogram				Pap test			
post	-0.0274***	-0.0289***	-8.96e-05**	-0.0461***	-0.0391***	-0.0374***	-9.63e-06	-0.0599***
	(0.000880)	(0.00123)	(4.30e-05)	(0.00197)	(0.000817)	(0.00115)	(2.05e-05)	(0.00184)
postXawv		0.0186*	0.000822*	0.0300*		-0.0220**	-0.000179	-0.0331**
		(0.0109)	(0.000463)	(0.0172)		(0.00935)	(0.000204)	(0.0155)
Observations	4,810,512	4,810,512	1,799,202	3,011,310	4,810,512	4,810,512	1,799,202	3,011,310
R-squared	0.622	0.622	0.231	0.547	0.391	0.391	0.189	0.374

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Table B6 – Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Pelvic test							
post	-0.0168***	-0.0155***	1.33e-05	-0.0248***				
	(0.000922)	(0.00147)	(2.03e-05)	(0.00236)				
postXawv		-0.0167	-0.000173	-0.0256				
		(0.0122)	(0.000185)	(0.0195)				
Observations	4,810,512	4,810,512	1,799,202	3,011,310				
R-squared	0.446	0.446	0.167	0.430				
	Conoloscopy among average risk beneficiareis				Conoloscopy among high risk beneficiareis			
post	-0.00194***	-0.00241***	-0.00307***	-0.00202***	0.000282	0.000162	0.000256	0.000107
	(0.000201)	(0.000292)	(0.000421)	(0.000343)	(0.000226)	(0.000341)	(0.000485)	(0.000358)
postXawv		0.00606**	0.00929**	0.00417		0.00156	0.000621	0.00212
		(0.00279)	(0.00419)	(0.00331)		(0.00399)	(0.00535)	(0.00401)
Observations	4,810,512	4,810,512	1,799,202	3,011,310	4,810,512	4,810,512	1,799,202	3,011,310
R-squared	0.164	0.164	0.164	0.164	0.177	0.177	0.176	0.177
	Colorectal screening: FOBT				Colorectal screening: Blood			
post	0.00689***	0.00343***	0.00252***	0.00398***	-0.0268***	-0.0238***	-0.0216***	-0.0250***
	(0.000736)	(0.00101)	(0.000955)	(0.00121)	(0.000935)	(0.00134)	(0.00143)	(0.00150)
postXawv		0.0452***	0.0522***	0.0410***		-0.0389***	-0.0648***	-0.0237
		(0.0126)	(0.0118)	(0.0147)		(0.0139)	(0.0164)	(0.0146)
Observations	4,810,512	4,810,512	1,799,202	3,011,310	4,810,512	4,810,512	1,799,202	3,011,310
R-squared	0.385	0.385	0.376	0.389	0.388	0.388	0.402	0.381
	Colorectal screening: flexible sig							
post	-4.86e-05**	-3.79e-05	-5.71e-05	-2.65e-05				
	(2.05e-05)	(3.16e-05)	(5.36e-05)	(3.75e-05)				

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Table B6 – Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
postXawv		-0.000140	-3.85e-05	-0.000200				
		(0.000298)	(0.000437)	(0.000397)				
Observations	4,810,512	4,810,512	1,799,202	3,011,310				
R-squared	0.180	0.180	0.181	0.178				
	Colorectal screening: sig, barium				Colorectal screening: col, barium			
post	-1.37e-05**	-2.41e-05***	-3.08e-05**	-2.01e-05*	-6.24e-06	-1.53e-05	-3.25e-05**	-5.19e-06
	(5.64e-06)	(9.01e-06)	(1.37e-05)	(1.04e-05)	(4.96e-06)	(1.04e-05)	(1.48e-05)	(1.06e-05)
postXawv		0.000136*	0.000141	0.000133		0.000118	0.000338**	-1.03e-05
		(7.00e-05)	(9.92e-05)	(8.73e-05)		(8.49e-05)	(0.000137)	(8.47e-05)
Observations	4,810,512	4,810,512	1,799,202	3,011,310	4,810,512	4,810,512	1,799,202	3,011,310
R-squared	0.189	0.189	0.198	0.181	0.167	0.167	0.167	0.167

Notes: The table shows the estimates of the regressions using equation (2.6) for preventive services that are affected by the MPB.

Table B7: Placebo Tests: Change of Preventive Services not Affected by MPB

	(1) All	(2) All	(3) Male	(4) Female	(5) All	(6) All	(7) Male	(8) Female
	Flu vaccination				Pneumococcal vaccination			
post	0.107***	0.0992***	0.0727***	0.115***	-0.00597***	-0.00692***	-0.00943***	-0.00541***
	(0.00358)	(0.00531)	(0.00603)	(0.00506)	(0.000660)	(0.00103)	(0.00133)	(0.00105)
postXawv		0.103*	0.0716	0.120**		0.0124	0.00999	0.0137
		(0.0530)	(0.0611)	(0.0492)		(0.0116)	(0.0145)	(0.0115)
Observations	4,810,512	4,810,512	1,799,202	3,011,310	4,810,512	4,810,512	1,799,202	3,011,310
R-squared	0.589	0.589	0.607	0.579	0.153	0.153	0.153	0.153
	Cardiovascular disease screening				Diabetes screening test			
post	0.0142***	0.0124**	-0.0175***	0.0304***	-0.0118***	-0.0111***	-0.0135***	-0.00960***
	(0.00345)	(0.00555)	(0.00548)	(0.00581)	(0.000773)	(0.00111)	(0.00139)	(0.00110)
postXawv		0.0240	-0.00218	0.0377		-0.00953	-0.0268*	0.000441
		(0.0499)	(0.0473)	(0.0542)		(0.0108)	(0.0139)	(0.0104)
Observations	4,810,512	4,810,512	1,799,202	3,011,310	4,810,512	4,810,512	1,799,202	3,011,310
R-squared	0.611	0.611	0.642	0.594	0.467	0.467	0.479	0.458
	Glaucoma screening				Diabetes self-management training			
post	1.62e-05	1.98e-06	-7.94e-06	7.93e-06	0.000171*	0.000373**	0.000421*	0.000347**
	(1.72e-05)	(2.15e-05)	(2.33e-05)	(2.51e-05)	(0.000100)	(0.000160)	(0.000234)	(0.000156)
postXawv		0.000186	0.000191	0.000182		-0.00264*	-0.00541**	-0.00102
		(0.000163)	(0.000169)	(0.000223)		(0.00153)	(0.00225)	(0.00148)
Observations	4,810,512	4,810,512	1,799,202	3,011,310	4,810,512	4,810,512	1,799,202	3,011,310
R-squared	0.219	0.219	0.220	0.219	0.303	0.303	0.298	0.307

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Table B7 – Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Prostate cancer screening				Diagnostic colonoscopy			
post	-0.0212***	-0.0210***	-0.0560***	-3.63e-05	-0.0192***	-0.0172***	-0.0220***	-0.0143***
	(0.00104)	(0.00170)	(0.00451)	(3.10e-05)	(0.000702)	(0.000919)	(0.00139)	(0.000923)
postXawv		-0.00151	-0.00610	-0.000306		-0.0257***	-0.0347**	-0.0207**
		(0.0156)	(0.0409)	(0.000328)		(0.00989)	(0.0157)	(0.00994)
Observations	4,810,512	4,810,512	1,799,202	3,011,310	4,810,512	4,810,512	1,799,202	3,011,310
R-squared	0.479	0.479	0.430	0.171	0.192	0.192	0.195	0.189

Notes: The table shows the estimates of the regressions using equation (2.6) for preventive services that are not affected by the MPB.

B.3 DATA APPENDIX: DEFINITIONS OF USAGES

Treated (copayment/coinsurance waived, and deductible waived):

- AAA_{izt}: HCPCS code is 'G0389'.
- Hbv_{izt}: HCPCS codes are: '90739', '90740', '90743', '90744', '90746', '90747', 'G0010'.
- Mnt_{izt}: HCPCS codes: '97802', '97803', '97804', 'G0270', 'G0271'.
- Pap_{izt}: HCPCS codes are: 'G0123', 'G0124', 'G0141', 'G0143', 'G0144', 'G0145', 'G0147', 'G0148', 'P3000', 'P3001', 'Q0091'.
- $Pelv_{izt}$: HCPCS code: 'G0101'.
- $Mamm_{izt}$: HCPCS codes: '77052', '77057', '77063', 'G0202';.
- $Bnmss_{izt}$: HCPCS codes are:'76977', '77078', '77080', '77081', 'G0130'.
- $ClrctLowRisk_{izt}$: HCPCS code is 'G0121'.
- $ClrctHighRisk_{izt}$: HCPCS code is 'G0105'.
- Sig_{izt}: HCPCS code is 'G0104'.
- $Fobt_{izt}$: HCPCS code is 'G0328'.
- $Blood_{izt}$:HCPCS code is '82270'.

Somewhat treated (copayment/coinsurance applies, but deductible waived):

- $SigBarium_{izt}$: HCPCS code is 'G0106'; alternative to G0104.
- $ColBarium_{izt}$: HCPCS code is 'G0120'; alternative to G0105.

Placebo services (not affected by the MPB):

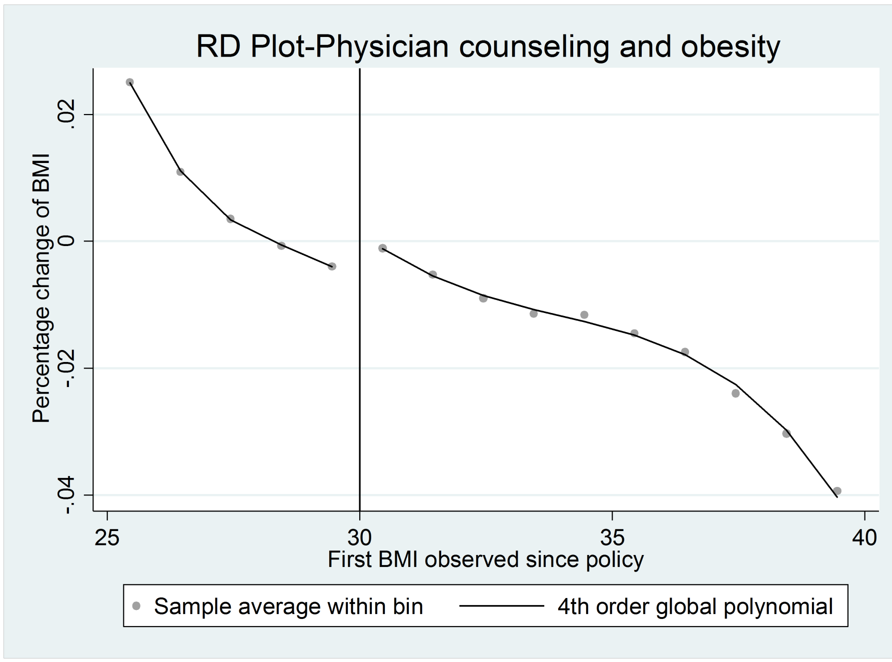
- $ClrctDiagnostic_{izt}$: HCPCS code is '44388', '44389', '44390', '44391', '44392', '44393', '44394', '44397', '45355', '45378', '45379', '45380', '45381', '45382', '45383', '45384', '45385', '45386', '45387', '45391', and '45392'.
- $Prstt_{izt}$: HCPCS code is 'G0103', and 'G0102'.
- $Card_{izt}$: HCPCS code is '80061', '82465', '83718', and '84478'.
- $Glucm_{izt}$: HCPCS code is 'G0117', and 'G0118'.
- $Dbtsscrn_{izt}$: HCPCS code is '82947', '82950', and '82951'.
- $Dbtsslfmgmt_{izt}$: HCPCS code is 'G0108', and 'G0109'.
- Flu_{izt}: HCPCS code is '90653', '90654', '90655', '90656', '90657', '90660', '90661', '90662', '90672', '90673', '90685', '90686', '90687', '90688', 'Q2034', 'Q2035', 'Q2036', 'Q2037', 'Q2038', 'Q2039', and 'G0008'.
- $Pneum_{izt}$: HCPCS code is '90670', '90732', and 'G0009'.

APPENDIX C

CHAPTER 3 APPENDIX

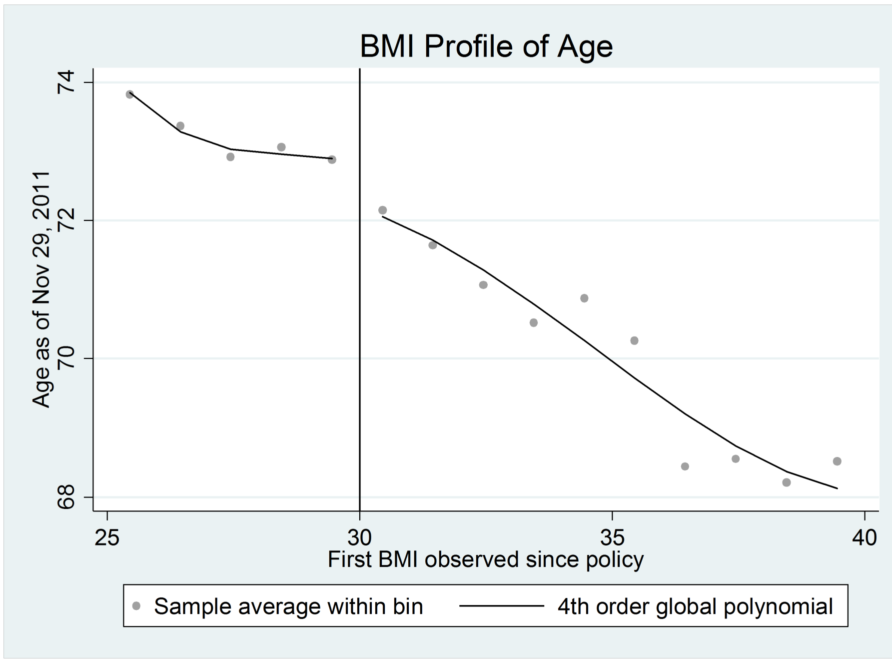
C.1 FIGURES

Figure C1: BMI Profile of Percentage Change of BMI



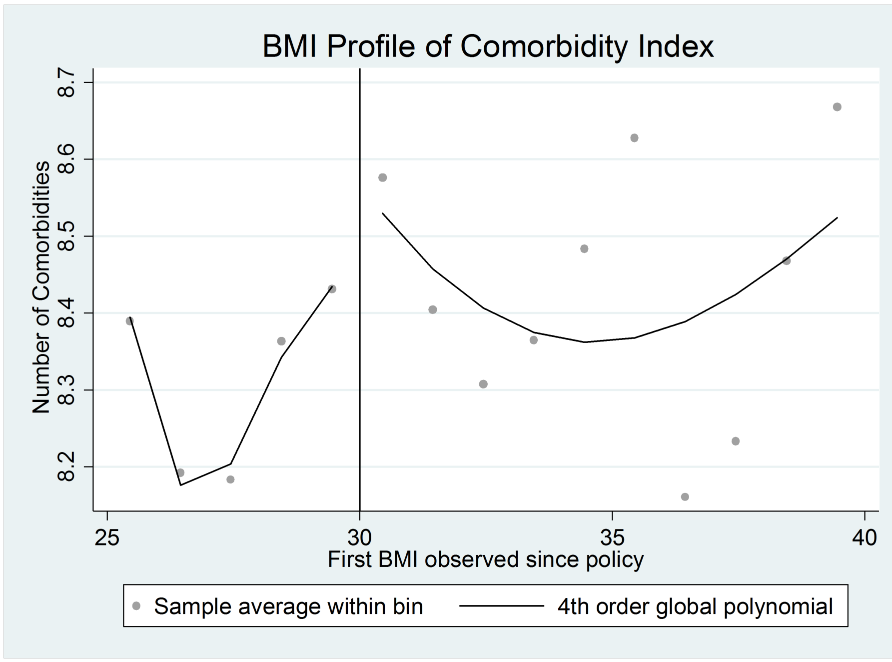
Notes: The y-axis is the percentage change of BMI during the first and the final observation of BMI. The x-axis is the first BMI observed since the start of the IBT program. The fitted line is drawn controlling for the polynomials up to the fourth order.

Figure C2: BMI Profile of Age



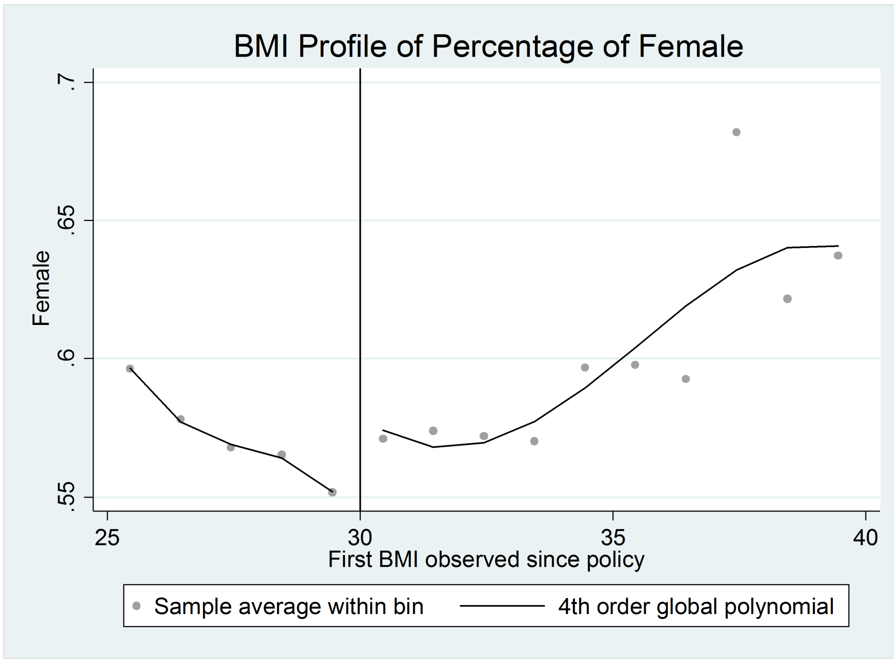
Notes: The y-axis is age. The x-axis is the first BMI observed since the start of the IBT program. The fitted line is drawn controlling for the polynomials up to the fourth order.

Figure C3: BMI Profile of co-morbidity Index



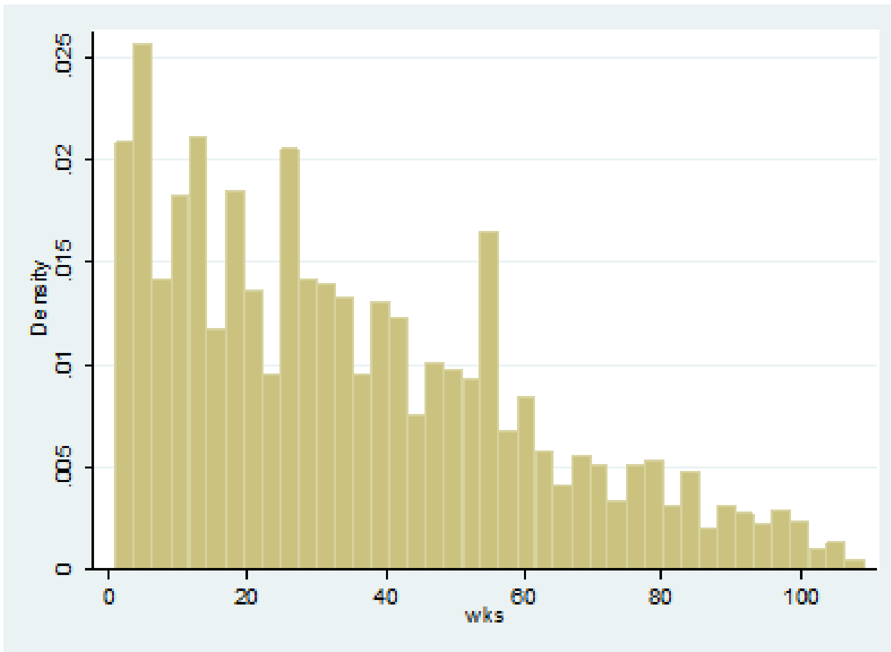
Notes: The y-axis is co-morbidity index. The x-axis is the first BMI observed since the start of the IBT program. The fitted line is drawn controlling for the polynomials up to the fourth order.

Figure C4: BMI profile of Percentage of females



Notes: The y-axis is a dummy variable for being female. The x-axis is the first BMI observed since the start of the IBT program. The fitted line is drawn controlling for the polynomials up to the fourth order.

Figure C5: Distribution of the Number of Weeks Between Observed BMIs



Notes: The variable equals the number of weeks between the first and last observed BMI, for each beneficiary in the sample.

C.2 TABLES

Table C1: Summary Statistics by Qualification Status (BMI$<$30 and BMI$\geq$30)

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max	(6) N	(7) mean	(8) sd	(9) min	(10) max
	First observed BMI$<$30					First observed BMI$\geq$30				
First BMI since policy	6,712	27.52	1.427	25.45	29.45	6,401	33.42	2.573	30.45	39.45
Last BMI	6,712	27.68	1.755	25.45	39.45	6,401	33.03	2.879	25.45	39.45
Pct change of BMI	6,712	0.00624	0.0484	-0.136	0.55	6,401	-0.0109	0.054	-0.338	0.296
Ever use IBT	6,712	0	0	0	0	6,401	0.0892	0.285	0	1
# IBT use	6,712	0	0	0	0	6,401	0.356	1.626	0	51
# co-morbidity	6,712	8.304	3.482	0	19	6,401	8.435	3.426	0	21
Female	6,712	0.571	0.495	0	1	6,401	0.588	0.492	0	1
Unknown	6,712	0.00164	0.0405	0	1	6,401	0.00219	0.0467	0	1
White	6,712	0.858	0.349	0	1	6,401	0.844	0.363	0	1
Black	6,712	0.0766	0.266	0	1	6,401	0.103	0.304	0	1
Other	6,712	0.0182	0.134	0	1	6,401	0.0133	0.114	0	1
Asian	6,712	0.0164	0.127	0	1	6,401	0.00859	0.0923	0	1
Hispanic	6,712	0.0283	0.166	0	1	6,401	0.0258	0.158	0	1
Native	6,712	0.00119	0.0345	0	1	6,401	0.00328	0.0572	0	1
Age 22-64	6,712	0.1	0.3	0	1	6,401	0.161	0.367	0	1
Age 65-69	6,712	0.213	0.41	0	1	6,401	0.233	0.423	0	1
Age 70-74	6,712	0.231	0.421	0	1	6,401	0.238	0.426	0	1
Age 75-79	6,712	0.199	0.4	0	1	6,401	0.191	0.393	0	1
Age 80-84	6,712	0.148	0.355	0	1	6,401	0.117	0.321	0	1
Age 85 and over	6,712	0.108	0.31	0	1	6,401	0.0603	0.238	0	1

Table C2: Summary Statistics by IBT Usage Among the Eligible Sample (BMI≥30)

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max	(6) N	(7) mean	(8) sd	(9) min	(10) max
		Never used IBT					Ever used IBT			
First BMI since policy	5,830	33.41	2.568	30.45	39.45	571	33.5	2.629	30.45	39.45
Last BMI	5,830	33	2.904	25.45	39.45	571	33.34	2.588	25.45	39.45
Pct change of BMI	5,830	-0.0116	0.0541	-0.338	0.296	571	-0.00336	0.0529	-0.203	0.263
Ever use IBT	5,830	0	0	0	0	571	1	0	1	1
# IBT use	5,830	0	0	0	0	571	3.991	3.892	1	51
# co-morbidity	5,830	8.368	3.419	0	21	571	9.119	3.422	1	20
Female	5,830	0.587	0.492	0	1	571	0.594	0.492	0	1
Unknown	5,830	0.00172	0.0414	0	1	571	0.00701	0.0835	0	1
White	5,830	0.847	0.36	0	1	571	0.816	0.388	0	1
Black	5,830	0.102	0.302	0	1	571	0.114	0.318	0	1
Other	5,830	0.0129	0.113	0	1	571	0.0175	0.131	0	1
Asian	5,830	0.00909	0.0949	0	1	571	0.0035	0.0591	0	1
Hispanic	5,830	0.0245	0.155	0	1	571	0.0385	0.193	0	1
Native	5,830	0.00326	0.057	0	1	571	0.0035	0.0591	0	1
Age 22-64	5,830	0.16	0.367	0	1	571	0.166	0.373	0	1
Age 65-69	5,830	0.231	0.422	0	1	571	0.249	0.433	0	1
Age 70-74	5,830	0.237	0.425	0	1	571	0.252	0.435	0	1
Age 75-79	5,830	0.192	0.394	0	1	571	0.186	0.389	0	1
Age 80-84	5,830	0.119	0.324	0	1	571	0.0928	0.29	0	1
Age 85 and over	5,830	0.0609	0.239	0	1	571	0.0543	0.227	0	1

Table C3: Impact of Intensive Behavioral Therapy on Obesity: Main Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Reduced	OLS	IV	IV	Reduced	OLS	IV	IV
qualification	0.00857**				0.00858**			
	-0.00384				-0.00405			
Use IBT		0.00879***	0.0902**			0.00663***	0.0976**	
		-0.00223	-0.0411			-0.00241	-0.0462	
# IBT use				0.0231**				0.0268**
				-0.0107				-0.0131
COV					Y	Y	Y	Y
HRR FE					Y	Y	Y	Y
co-morbidity index					Y	Y	Y	Y
Ever diag of chronic cond					Y	Y	Y	Y
New diag of chronic cond					Y	Y	Y	Y
#weeks elapsed FE					Y	Y	Y	Y
Observations	13,113	13,113	13,113	13,113	13,113	13,113	13,113	13,113
R-squared	0.061	0.062			0.108	0.108		
T-stat of instrument			10.45	7.01			9.43	5.06

Notes: The dependent variable equals the percentage change of the body weight during November 29, 2011 and December 31, 2013. *** p<0.01, ** p<0.05, * p<0.1.

Table C4: Sub-Sample Impacts (IV): By Gender and Race

	(1) Female	(2) Female	(3) Male	(4) Male	(5) White	(6) White	(7) Black	(8) Black	(9) Asian	(10) Asian	(11) Hispanic	(12) Hispanic
Use IBT	0.0601		0.137**		0.110**		0.0583		-6.251		-2.279	
	(0.0518)		(0.0679)		(0.0438)		(0.128)		)18.49)		(16.83)	
# IBT use		0.014		0.0423*		0.0282**		0.014		3.748		-0.0895
		(0.0122)		(0.0225)		(0.0116)		(0.0306)		(20)		(0.143)
Observations	7,596	7,596	5,517	5,517	11,161	11,161	1,171	1,171	165	165	355	355

Notes: The dependent variable equals the percentage change of the body weight during November 29, 2011 and December 31, 2013. *** p<0.01, ** p<0.05, * p<0.1.

Table C5: Sub-Sample Impacts (IV): By Age Groups

	(1) 22-64	(2) 22-64	(3) 65-69	(4) 65-69	(5) 70-74	(6) 70-74	(7) 75-79	(8) 75-79	(9) 80-84	(10) 80-84	(11) 85over	(12) 85over
Use IBT	0.154		0.169*		0.146		0.00578		0.118		0.0115	
	(0.148)		(0.0903)		(0.111)		(0.0736)		(0.117)		(0.109)	
# IBT use		0.0419		0.0363*		0.0399		0.00141		0.0324		0.00381
		(0.0421)		(0.0204)		(0.0319)		(0.018)		(0.0332)		(0.0361)
Observations	1,701	1,701	2,922	2,922	3,074	3,074	2,562	2,562	1,744	1,744	1,110	1,110

Notes: The dependent variable equals the percentage change of the body weight during November 29, 2011 and December 31, 2013. *** p<0.01, ** p<0.05, * p<0.1.

Table C6: Effects of IBT and Smoking Counseling

	(1)	(2)	(3)	(4)
SAMPLES	no smk counseling	no smk counseling	smk counseling	smk counseling
IBT use	0.0772***		0.0671	
	(0.0236)		(0.0519)	
IBT num		0.0220***		0.0146
		(0.00718)		(0.0112)
Observations	12,829	12,829	284	284

Notes: The dependent variable equals the percentage change of the body weight during November 29, 2011 and December 31, 2013. *** p<0.01, ** p<0.05, * p<0.1.

Table C7: Effects of IBT and Smoking

	(1)	(2)	(3)	(4)
SAMPLES	non-smokers	non-smokers	smokers	smokers
IBT use	0.0800***		0.0406	
	(0.0233)		(0.0715)	
IBT num		0.0234***		0.00764
		(0.00737)		(0.0133)
Observations	12,077	12,077	1,036	1,036

Notes: The dependent variable equals the percentage change of the body weight during November 29, 2011 and December 31, 2013. *** p<0.01, ** p<0.05, * p<0.1.

Table C8: Effects of IBT and Massage

	(1)	(2)	(3)	(4)
SAMPLES	no massage	no massage	massage	massage
IBT use	0.0769***		0.0297	
	(0.0223)		(0.175)	
IBT num		0.0221***		0.00189
		(0.00683)		(0.0109)
Observations	13,039	13,039	74	74

Notes: The dependent variable equals the percentage change of the body weight during November 29, 2011 and December 31, 2013. *** p<0.01, ** p<0.05, * p<0.1.

Table C9: Effects of IBT and the Psychological Therapy

	(1)	(2)	(3)	(4)
SAMPLES	no psytherapy	no psytherapy	psytherapy	psytherapy
IBT use	0.0781***		-0.0977	
	(0.0221)		(0.259)	
IBT num		0.0220***		-0.0145
		(0.00666)		(0.0405)
Observations	12,841	12,841	272	272

Notes: The dependent variable equals the percentage change of the body weight during November 29, 2011 and December 31, 2013. *** p<0.01, ** p<0.05, * p<0.1.

Table C10: Effects of IBT and the Bariatric Procedures

	(1)	(2)
SAMPLES	no bariatric	no bariatric
IBT use	0.0772***	
	(0.0221)	
IBT num		0.0215***
		(0.00654)
Observations	13,109	13,109

Notes: The dependent variable equals the percentage change of the body weight during November 29, 2011 and December 31, 2013. *** p<0.01, ** p<0.05, * p<0.1.

Table C11: Effects of IBT Among Beneficiaries who Took No Alternative Procedures

	(1)	(2)
SAMPLES	none of the other procedures	none of the other procedures
IBT use	0.0816***	
	(0.0237)	
IBT num		0.0252***
		(0.00799)
Observations	11,785	11,785

Notes: The dependent variable equals the percentage change of the body weight during November 29, 2011 and December 31, 2013. *** p<0.01, ** p<0.05, * p<0.1.

Table C12: ICD-9 Codes with BMI information

ICD-9 Code	Description	Assigned BMI
V8521	BMI of 25.0-25.9	25.45
V8522	BMI of 26.0-26.9	26.45
V8523	BMI of 27.0-27.9	27.45
V8524	BMI of 28.0-28.9	28.45
V8525	BMI of 29.0-29.9	29.45
V8530	BMI of 30.0-30.9	30.45
V8531	BMI of 31.0-31.9	31.45
V8532	BMI of 32.0-32.9	32.45
V8533	BMI of 33.0-33.9	33.45
V8534	BMI of 34.0-34.9	34.45
V8535	BMI of 35.0-35.9	35.45
V8536	BMI of 36.0-36.9	36.45
V8537	BMI of 37.0-37.9	37.45
V8538	BMI of 38.0-38.9	38.45
V8539	BMI of 39.0-39.9	39.45

Table C13: Top Procedures Taken, Beneficiaries with ICD-9 codes of V85.25-V85.39), 2011-2013

HCPCS/CPT	Pct. of Lines	Cum Pct.	Description
99213	6.33	6.33	Level 3 Established Office Visit (99213) This level of care is located "in the middle' of the coding spectrum for office visits with established patients. The 99213 is the second most popular choice for internists who select this level of care for about 35% of these encounters in 2012. Usually the presenting problems are of low to moderate severity. The reimbursement for this level of care is approximately $73 and is worth 0.97 work RVUs. The documentation for this encounter requires TWO out of THREE of the following: 1) Expanded Problem Focused History 2) Expanded Problem Focused Exam 3) Low Complexity Medical Decision-Making Or 15 minutes spent face-to-face with the patient if coding based on time. The appropriate documentation must be included.
99214	5.46	11.79	Established Outpatient: CPT Code 99214 A. Key Components (2 of 3 meet or exceed requirements) 1.E/M Detailed History 2.E/M Detailed Exam 3.E/M Moderate Complexity Medical Decision B. Problem Severity 1.E/M Moderate Severity Problem 2.E/M High Severity Problem C. Physician Time: 25 minutes
36415	3.44	15.23	Collection of venous blood by venipuncture
G8553	2.28	17.52	Prescription(s) generated and transmitted via a qualified erx system
85025	1.83	19.35	Complete Blood Count, with differential WBC, automated
80053	1.82	21.17	Comprehensive metabolic panel
99232	1.74	22.9	Subsequent hospital care
97110	1.57	24.47	Therapeutic exercises to develop strength and endurance, range of motion, and flexibility (15 minutes)
80061	1.45	25.92	Lipid panel test
G8427	1.17	27.1	Eligible Professional Attests To Documenting In The Medical Record They Obtained, Updated, Or Reviewed The Patient's Current Medications
85610	1.06	28.16	Prothrombin time (PT) (It is a blood test that measures how long it takes blood to clot.)
99212	1.05	29.21	Level 2 Office Visit (99212) This is the second lowest level of care for an established patient being seen in the office. Internists used this code for about 2% of these encounter in 2012. Usually the presenting problems are self-limited or minor. The Medicare allowable reimbursement for this code is approximately $44 and it is worth 0.48 work RVUs.

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HCPCS/CPT	Pct. of Lines	Cum Pct.	Description
			Documentation requires TWO out of THREE of the following : 1) Problem Focused History 2) Problem Focused Exam 3) Straightforward Medical Decision-Making Or 10 minutes spent face-to-face with the patient if coding based on time. The appropriate documentation must be included.
97140	1.04	30.25	Manual therapy techniques consist of, but are not limited to, connective tissue massage, joint mobilization and manipulation, manual traction, passive range of motion, soft tissue mobilization and manipulation, and therapeutic massage including manual lymphatic drainage, one or more regions, each 15 minutes.
83036	1.03	31.28	glycosylated (A1c)
84443	0.99	32.27	Assay thyroid stim hormone
93010	0.92	33.19	EKG
1036F	0.81	34	Current tobacco non-user
93000	0.79	34.79	Electrocardiogram (ECG or EKG)
G0008	0.74	35.53	Administration Of Influenza Virus Vaccine
88305	0.74	36.26	Pathology Examination of Tissue Using a Microscope
98941	0.73	36.99	Chiropractic manipulative treatment (CMT); spinal, 3 to 4 regions.
99233	0.72	37.72	subsequent hospital care
71020	0.69	38.4	Chest x-rays
96372	0.66	39.06	Therapeutic, prophylactic, or diagnostic injection (specify substance or drug); subcutaneous or intramuscular
71010	0.63	39.69	Chest x-rays
92014	0.62	40.32	Ophthalmological services: medical examination and evaluation, with initiation or continuation of diagnostic and treatment program; comprehensive, established patient, one or more visits
99203	0.62	40.93	Level 3 New Patient Office Visit (99203) Perhaps because it is located “in the middle, the 99203 is the most frequently used code for new office patients. Internists use this code for 22% of these encounters in 2012. The Medicare allowable reimbursement for this visit is about $108 and it is worth 1.42 work RVUs. Usually the presenting problems are of mild to moderate severity. The documentation for this encounter requires THREE out of THREE of the following: 1) Detailed History 2) Detailed Exam 3) Low Complexity Medical Decision-Making Or 30 minutes spent face-to-face with the patient if coding based on time. The appropriate documentation must be included.
99204	0.58	41.51	Level 4 New Patient Office Visit (99204) This is the most popular code used to bill for new patients being seen in the office. Internists select the 99204 code for 47% of these encounters in 2012. The Medicare allowable reimbursement for this level of care is approximately $166 and it is worth 2.43 work RVUs. Usually the presenting problems are of moderate to high severity.

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HCPCS/CPT	Pct. of Lines	Cum Pct.	Description
			The documentation for this encounter requires THREE out of THREE of the following:
			1) Comprehensive History
			2) Comprehensive Exam
			3) Moderate Complexity Medical Decision-Making
			Or 45 minutes spent face-to-face with the patient if coding based on time. The appropriate documentation must be included.
G0283	0.55	42.06	Electrical Stimulation (Unattended), To One Or More Areas For Indication(S) Other Than Wound Care, As Part Of A Therapy Plan Of Care
99215	0.54	42.6	Level 5 Office Visit (99215)
			The 99215 represents the highest level of care for established patients being seen in the office. Internists selected the 99215 level of care for only about 9% of established office patients in 2012. The Medicare allowable reimbursement for this level of care is approximately $144 and it is worth 2.11 work RVUs. Usually the problems are of moderate to high severity.
			The documentation for this encounter requires TWO out of THREE of the following:
			1) Comprehensive History
			2) Comprehensive Exam
			3) High Complexity Medical Decision-Making
			Or 40 minutes spent face-to-face with the patient if coding based on time. The appropriate documentation must be included.

Table C14: Top Diagnoses of all claims, IBT users, 2011-2013

ICD-9 Codes	Pct. of All Diagnoses	Cum. Pct.	Description
4019	3.67	3.67	Hypertension NOS (Unspecified Essential Hypertension)
25000	3.47	7.14	DMII Wo Cmp Nt St Uncntr (Diabetes Mellitus Without Mention Of Complication, Type II Or Unspecified Type, Not Stated As Uncontrolled)
4011	3.06	10.2	Benign Hypertension (Benign Essential Hypertension)
2724	2.67	12.87	Hyperlipidemia NEC/NOS (Other And Unspecified Hyperlipidemia)
42731	1.59	14.46	Atrial Fibrillation (An irregular, often rapid heart rate that commonly causes poor blood flow.)
2720	1.43	15.89	Pure Hypercholesterolemia (high amounts of cholesterol in the blood)
2449	1.15	17.04	Hypothyroidism NOS (Unspecified Acquired Hypothyroidism) (underactive thyroid)
27800	1.14	18.18	Obesity NOS (Obesity, unspecified)
2722	1.14	19.32	Mixed hyperlipidemia (A condition in which there are high levels of fat particles (lipids) in the blood.)
2689	1.08	20.4	Vitamin D Deficiency NOS (Unspecified Vitamin D Deficiency)
7242	1.06	21.46	Lumbago (Low back pain)
7295	1	22.45	Pain In Limb
25002	0.96	23.41	DMII Wo Cmp Uncntrld (Diabetes Mellitus Without Mention Of Complication, Type II Or Unspecified Type, Uncontrolled)
V5869	0.95	24.36	Long-term (current) use of other medications
78079	0.94	25.3	Malaise And Fatigue NEC (Other Malaise And Fatigue)
41401	0.94	26.24	Crnry Athrscl Natve Vssl (Coronary Atherosclerosis Of Native Coronary Artery)
2859	0.86	27.1	Anemia NOS (Anemia, Unspecified)
78605	0.77	27.87	Shortness Of Breath
5990	0.76	28.63	Urin Tract Infection NOS (Urinary Tract Infection, Site Not Specified)
41400	0.7	29.33	Cor Ath Unsp Vsl Ntv/Gft (Coronary Atherosclerosis Of Unspecified Type Of Vessel, Native Or Graft)
V700	0.7	30.04	Routine Medical Exam (Routine General Medical Examination At A Health Care Facility)
V0481	0.7	30.74	Vaccine For Influenza (Need For Prophylactic Vaccination And Inoculation Against Influenza)
1101	0.66	31.4	Dermatophytosis Of Nail
V5861	0.62	32.02	Long-term (current) use of anticoagulants
496	0.6	32.62	Chronic airway obstruction, not elsewhere classified
4280	0.6	33.22	CHF NOS (Congestive heart failure, unspecified)
71946	0.58	33.8	Joint pain-l/leg (Pain in joint, lower leg)
7244	0.57	34.37	Lumbosacral neuritis NOS (Thoracic or lumbosacral neuritis or radiculitis, unspecified)
78650	0.57	34.95	Chest pain NOS (Chest pain, unspecified)
53081	0.55	35.5	Esophageal reflux (a chronic condition of mucosal damage caused by stomach acid coming up from the stomach into the esophagus (chronic reflux))

Continued on Next Page...

ICD-9 Codes	Pct. of All Diagnoses	Cum. Pct.	Description
71941	0.52	36.02	Joint pain-shlder (Pain in joint, shoulder region)
7393	0.52	36.54	Somat dysfunc lumbar reg (Nonallopathic lesions, lumbar region)
7823	0.5	37.04	Edema (a condition characterized by an excess of watery fluid collecting in the cavities or tissues of the body.)
36616	0.47	37.51	Senile nuclear cataract (Senile nuclear sclerosis)
72252	0.47	37.99	Lumb/lumbosac disc degen (Degeneration of lumbar or lumbosacral intervertebral disc)
71516	0.44	38.42	Loc prim osteoart-l/leg (Osteoarthrosis, localized, primary, lower leg)
7231	0.42	38.85	Cervicalgia (Neck pain)
5853	0.42	39.26	Chr kidney dis stage III (Chronic kidney disease, Stage III (moderate))
25060	0.41	39.67	DMII neuro nt st uncntrl (Diabetes with neurological manifestations, type II or unspecified type, not stated as uncontrolled)
7812	0.4	40.07	Abnormality of gait
4439	0.39	40.46	Periph vascular dis NOS (Peripheral vascular disease, unspecified)
7862	0.38	40.85	Cough
2662	0.38	41.22	B-complex defic NEC (Other B-complex deficiencies)
V8530	0.37	41.6	BMI 30.0-30.9,adult (Body Mass Index 30.0-30.9, adult)
78900	0.36	41.96	Abdmnal pain unspcf site (Abdominal pain, unspecified site)
7197	0.36	42.31	Difficulty in walking
27801	0.35	42.67	Morbid obesity
71596	0.35	43.02	Osteoarthros NOS-l/leg (Osteoarthrosis, unspecified whether generalized or localized, lower leg)
7804	0.35	43.37	Dizziness and giddiness
7291	0.34	43.71	Myalgia and myositis NOS (Myalgia and myositis, unspecified)
7020	0.34	44.05	Actinic keratosis (A rough, scaly patch on the skin caused by years of sun exposure.)
7391	0.34	44.39	Somat dysfunc cervic reg (Nonallopathic lesions, cervical region)
78609	0.34	44.72	Respiratory abnorm NEC (Other respiratory abnormalities)
40210	0.33	45.05	Benign hyp ht dis w/o hf (Benign hypertensive heart disease without heart failure)
32723	0.33	45.38	Obstructive sleep apnea (A potentially serious sleep disorder in which breathing repeatedly stops and starts.)
71945	0.32	45.7	Joint pain-pelvis (Pain in joint, pelvic region and thigh)
185	0.31	46.01	Malign neopl prostate (Malignant neoplasm of prostate)
71590	0.31	46.32	Osteoarthros NOS-unspec (Osteoarthrosis, unspecified whether generalized or localized, site unspecified)
V7612	0.31	46.63	Screen mammogram NEC (Other screening mammogram)
73300	0.3	46.93	Osteoporosis NOS (Osteoporosis, unspecified)
7906	0.29	47.23	Abn blood chemistry NEC (Other abnormal blood chemistry)
7243	0.29	47.51	Sciatica (Pain radiating along the sciatic nerve, which runs down one or both legs from the lower back.)
7392	0.29	47.8	Somat dysfunc thorac reg (Nonallopathic lesions, thoracic region)
72402	0.29	48.09	Spin sten,lumbr wo claud (Spinal stenosis, lumbar region, without neurogenic claudication)
7213	0.27	48.35	Lumbosacral spondylosis (Lumbosacral spondylosis without myelopathy)

Table C15: Provider Specialty of the IBT Services with Non-zero Payments from Medicare

Provider Specialty	**Pct. of all IBT lines**	**Cum. Pct.**	**Description**
11	62.5	62.5	11 = Internal medicine
8	28.49	90.99	08 = Family practice
50	4.64	95.63	50 = Nurse practitioner
1	1.67	97.3	01 = General practice
97	1.03	98.33	97 = Physician assistant (eff 5/92)
16	0.61	98.94	16 = Obstetrics/gynecology
39	0.36	99.3	39 = Nephrology
38	0.32	99.62	38 = Geriatric medicine
10	0.13	99.75	10 = Gastroenterology
37	0.1	99.85	37 = Pediatric medicine
46	0.04	99.89	46 = Endocrinology (eff 5/92)
6	0.02	99.9	06 = Cardiology
13	0.02	99.92	13 = Neurology
22	0.02	99.94	22 = Pathology
29	0.02	99.96	29 = Pulmonary disease
71	0.02	99.98	71 = Registered Dietician/Nutrition Professional (eff. 1/1/02)
84	0.02	100	84 = Preventive medicine (eff 5/92)

Table C16: Top 20 States of IBT Usage, 2011-2013

Rank	**Pct. of IBT lines**	**Cum. Pct.**	**State**
1	13.58	13.58	Florida
2	11.19	24.77	New York
3	8.98	33.75	California
4	7.75	41.5	Texas
5	7.0	48.5	New Jersey
6	6.05	54.55	North Carolina
7	4.49	59.04	Illinois
8	3.73	62.77	Tennessee
9	3.71	66.49	Michigan
10	3.6	70.08	Georgia
11	3.49	73.58	Indiana
12	3.33	76.91	South Carolina
13	1.93	78.84	Alabama
14	1.92	80.76	Arizona
15	1.84	82.6	Pennsylvania
16	1.74	84.34	Maryland
17	1.65	85.99	Massachusetts
18	1.36	87.35	Ohio
19	1.36	88.71	Oklahoma
20	1.18	89.9	Louisiana

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