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# Peer Effects in Breastfeeding: Evidence from the IFPS II Study

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***A*bstract:** We study breastfeeding in the context of social interactions, distinguishing between peer influences and intergenerational transfer of breastfeeding behavior. Using data from Infant Feeding Practices Study II, we estimate peer effects in breastfeeding decisions. There is strong evidence of peer effects, which may suggest the presence of the social multiplier in breastfeeding that could lead to an amplified social response to policy interventions. However, the prevalence of breastfeeding in a peer group needs to achieve some critical level in order for the peer effects to become significant. Knowing more than five peers who breastfed has a highly significant positive effect on the likelihood of breastfeeding at months three and six postpartum, and the duration of partial and exclusive breastfeeding. Our results suggest the presence of a positive externality in breastfeeding, which may result in an under-provision of the good (breastfeeding). Therefore, a Pigovian subsidy may be needed to promote breastfeeding and correct for the externality We also find evidence of inter-generational transmission of breastfeeding behavior, which may help explain why, despite active public health campaigns aimed at promoting breastfeeding, the prevalence of breastfeeding in the U.S. remains modest.

**Keywords:** Breastfeeding; Infant; Peer effects; Peer group; Social multiplier

**JEL Classification**s: D10, D71, I19, J13

## 1. Introduction

It is well-known and widely recognized in social sciences that one person's behavior often influences the behavior of neighbors, classmates, colleagues, peers, etc. This phenomenon, known as peer effects, or spillovers, has been widely studied in various areas of social science. Peer effects were shown to play a role in the spread of obesity (Christakis and Fowler, 2007; Cohen-Cole and Fletcher, 2008; Trogdon et al., 2008, and Valente et al., 2009), youth's attitudes toward risky behavior, such as cigarette smoking, alcohol drinking, drug use, and dropping out from school (Gaviria and Raphael, 2001; Powell et al., 2005; Clark and Loheac, 2007), academic performance

(Betts and Morell, 1999; Zimmerman, 2003), academic cheating (Carrell et al., 2008), and the choice of college major (DeGiorgi et al., 2010).

We analyze the effect of social interactions on women's breastfeeding decisions. Recently there has been a resurgence of interest in breastfeeding from the public health prospective. It is generally believed that breast milk is a superior nutrition source for infants and thus increasing the prevalence of breastfeeding could improve health outcomes of the younger generation and even improve the future human capital (Harder et al., 2005; Saarinen and Kajosaari, 1995; Homer and Simpson, 2007, Belfield and Kelly, 2012). Not surprisingly, raising breastfeeding rates across the United States earned the status of a priority goal for Centers of Disease Control and Prevention (CDC). The World Health Organization and the US Department of Health and Human Services recommend that infants should be exclusively breastfed for the first six months of life. The breastfeeding rates in the United States have been historically low. In 1970, the breastfeeding rate was 26.5%, after a steady increase and a slight decline, the breastfeeding rate was 51.5% in 1990; it had increased to 68.4% in 2000 and 75% in 2010, respectively.[1] Currently, the breastfeeding initiation rate barely reached the goal outlined in Health People in 2010, however, it still falls short of Health People 2020 Objectives, and the breastfeeding rates at 6 and 12 months remain stagnant and low and do not meet the objectives, despite active public health campaigns aimed at promoting breastfeeding.

Studies on peer influences in breastfeeding investigate the role of peer counseling and promotional videos provided by WIC (see for instance Gross et al., 1998) or information and social support that comes from social contacts, such as health professionals, friends or family members (Matich and Sims, 1992; Giugliani et al., 1994; Humphreys et al., 1998, DiGirolamo et al., 2005). Although it is very important to study the effects of peer counseling programs and social support, we also need to understand how woman's decision to breastfeed is affected by breastfeeding *decisions* of her peers. It is precisely this effect that gives rise to a social multiplier (Glaeser et al., 2002). The latter amplifies the effects of public policy measures, as any exogenous changes in the individual behavior will influence the peers' behavior, and then in turn the behavior of peers would influence the individual. To the best of our knowledge, our paper is the first to address this question.

The rest of the paper is organized as follows. In Section 2 we discuss data and estimation techniques. In Section 3 we present the estimation results. The last section concludes.

## 2. Data and Methodology

### 2.1 Data Description

We use data from the Infant Feeding Practices Study II (IFPS II) conducted by the U.S. Food and Drug administration. An advantage of our data is that the surveys are conducted concurrently with the behavior, in contrast to most surveys which are retrospective. IFPS II is a longitudinal consumer-based study and data were collected from May 2005 till June 2007 using a series of questionnaires. The prenatal questionnaire was sent when the woman was in the third trimester of pregnancy; the neonatal questionnaire was sent about three weeks after the baby's birth, and another ten questionnaires were mailed approximately monthly throughout the baby's first year of life.

The sample consists of 4902 women. The study excludes the mothers that were younger than 18 years old, who had a medical problem that was likely to affect the feeding decision, and those

[1] The breastfeeding rates for years 1970 through 1998 are from Ross Mothers Survey. Data source: http://kellymom.com/fun/trivia/ross-data/; the rates after 1998 are from Centers for Disease Control and Prevention. Data description: http://www.cdc.gov/breastfeeding/data/index.htm; raw data are available upon request from ifps@cdc.gov .

whose infant had at birth or developed an illness or condition that was likely to affect feeding decisions during the first year of life. The infants are required to be full or nearly full-term and a singleton, and weigh at least 5 pounds at birth.

An infant is considered exclusively breastfed if no other food or drink (aside from vitamins, minerals, and medicines) is consumed except breast milk. Following Chatterji et al. (2002), women who breastfed for less than one week were not considered to have initiated breastfeeding.

The descriptive statistics for covariates and dependent variables is available upon request from the Corresponding Author.[2] The sample averages of women's demographical characteristics are close to the corresponding national averages (for instance, 81.26% of women in our sample are white, compared to the national averages of 80.73 - 81.03% over the years of 2005 through 2007; 75.22% of respondents are married compared to the national averages of 68.61 - 75.67%). However, comparing to the statistics in the national sample, women in our study tend to be more educated (75.3% of women have some college education or higher, while the national averages were 69.81 - 70.75%). The latter could be explained by the following two features of the survey. First, women in our sample are more likely to comply with the requirements of the survey than are women chosen randomly from the U.S. population (the same is true about any opinion survey that relies on volunteer participants). Second, questionnaire completion required at least moderate literacy. Despite these limitations, IFPS II was found to be a valuable source of infant feeding data (Fein et al., 2008).

### 2.2 Empirical Methodology

We estimate three types of models: (1) breastfeeding initiation; (2) the likelihood of exclusive and partial breastfeeding at three and six months postpartum, and (3) the duration of partial and exclusive breastfeeding. To estimate the first two categories, we employ the linear probability and Probit specifications. For the linear probability model, the following structural equation is estimated:

$$\boldsymbol{Y} = \boldsymbol{X\beta} + \boldsymbol{u} \tag{1}$$

where $\boldsymbol{Y}$ is a binary dependent variable representing woman's breastfeeding decision, and $\boldsymbol{X}$ is a vector of exogenous variables, which include demographic and residential characteristics (age, marital status, race, and region of residence), peer effects, level of education, family income, contribution of mother's pay to family income prenatally (used as a proxy to mother's work status), cigarette smoking during pregnancy, comfort in nursing around close women friends, and whether mother had been breastfed as infant. The latter two are proxies for woman's intrinsic characteristics that affect breastfeeding but are unobservable to econometrician. The same exogenous variables are included in Probit model.

Peer effects are captured using three dummy variables, measuring the number of friends or relatives that woman knew prenatally who ever breastfed their babies. Information about peer effects is taken from Question 38 on prenatal questionnaire. The question reads "About how many of your friends and relatives have breastfed their babies?" Ideally the answer would take an integer value, however, for convenience of women who participated in the study, it was designed as a categorical variable. We introduced three dummy variables; each corresponds to a positive answer to one the following questions: "One or two," "Three to five," and "More than five".

If peer effects were measured by a counting variable taking integer values, we would generally expect a non-linear relation between the number of peers who breastfed and breastfeeding duration. The left panel of Figure 1 depicts breastfeeding duration as a function of the number of peers who

[2] The missing values are deleted for each variable; therefore, the numbers of observations for each variable are different and vary from 2092 to 4902.

breastfeed (the total effect), conditional on other exogenous variables being fixed. The right panel depicts the derivative of the total effect (the marginal effect). It is reasonable to expect that breastfeeding duration rises slowly when the number of peers is very small, then rises faster as the peer group continues to build up, and then rises slowly after the "critical size" of the peer group has been achieved. Such a relationship results in an inverse U-shaped marginal effect curve.

However, since peer effects in our study are measured by three dummy variables, we would expect the total effect to look like a step (piecewise-constant) function, depicted in Figure 2.

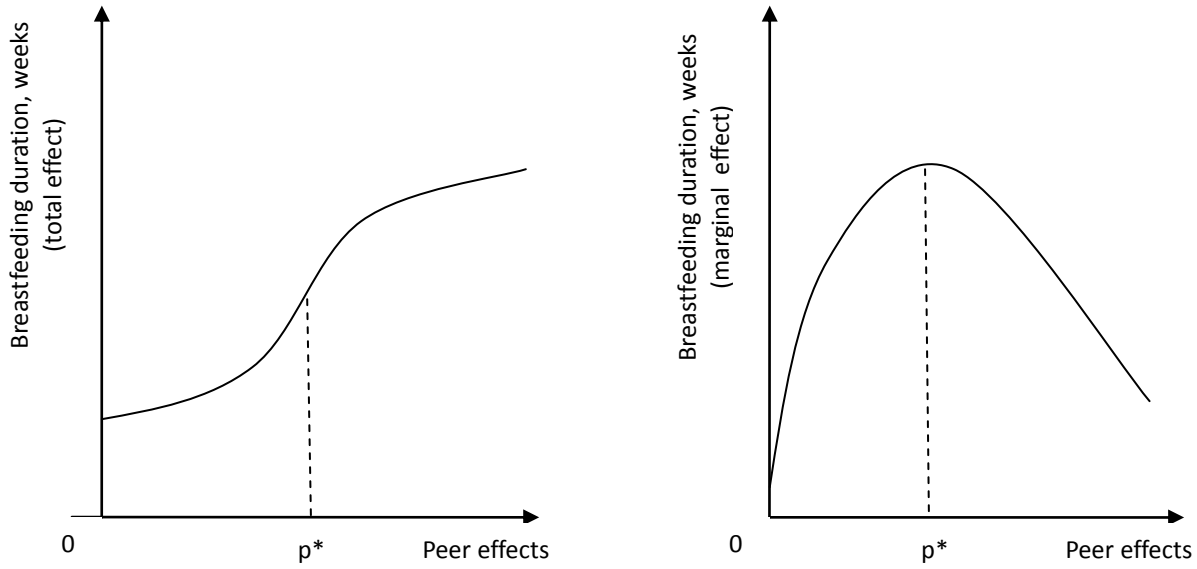


**Figure 1.** Peer effects (counting variable) and breastfeeding behavior (total versus marginal effect)

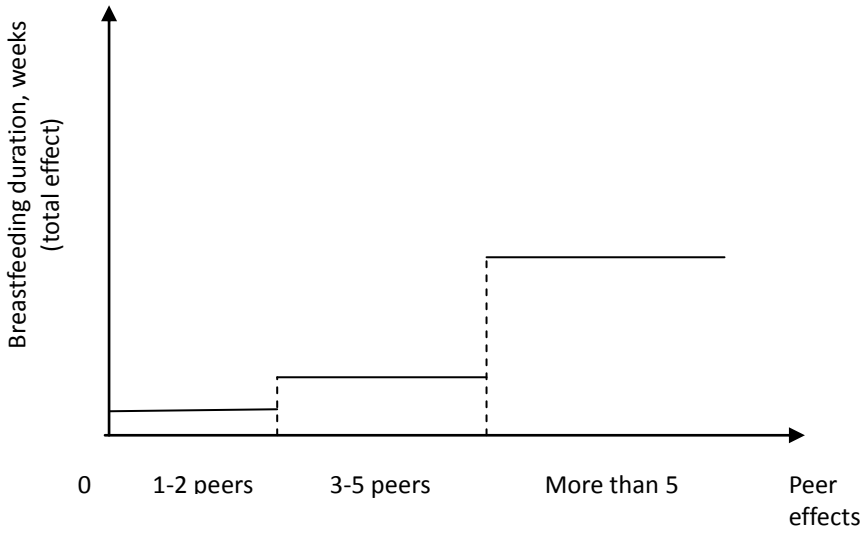


**Figure 2.** Peer effects (dummy variables) and breastfeeding behavior (total effect)

According to Manski (1993), one might observe correlation between breastfeeding decisions made by a woman and her peers because of: (1) endogenous effects, (2) exogenous, or contextual, effects, and (3) correlated effects. Endogenous effects are the "true" peer effects that we are trying to estimate. Exogenous (contextual) effects arise when a woman's breastfeeding decision is influenced by the exogenous characteristics of her peer group, for instance, the level of education, income, race/ethnicity, etc. Correlated effects arise due to correlation between unobservable characteristics of individuals within a peer group, which occurs, for instance, when individuals select their peers on the basis of those characteristics. To control for contextual effects, we use a rich set of covariates, which include various demographic and residential characteristics, age, education level, prenatal smoking, family income, etc. Ideally, we would use information at the individual peer group level (i.e., characteristics of each woman's peer group), however this data is not available to us. The above-mentioned covariates factors would also help us to address the self-selection problem that could give rise to correlated effects. It is reasonable to expect that women choose their friends on the basis of the aforementioned characteristics. We therefore assume, similar to Valente et al. (2009), that peer selection does not depend on unobservable characteristics that affect breastfeeding. This assumption is not completely innocuous, as there might still be variables, which are not present in the IFPS II data, that are correlated with both the selection into peer groups and breastfeeding decisions. However, the validity of the assumption is reinforced by the fact that, most likely, woman's and her peers' breastfeeding decisions are not made concurrently. Women report their peers' breastfeeding decisions on their *prenatal* questionnaire, which is taken *before* woman could initiate breastfeeding.

To estimate breastfeeding duration, we perform the baseline estimation by ordinary least squares (OLS). To account for upper censoring (because some mothers still breastfeed at their last survey), we estimate a two-limit Tobit model with the upper limit of 52 weeks.[3] As for exclusive breastfeeding, we do not have any right-censored observations because the recommended duration of exclusive breastfeeding is significantly shorter than that of partial breastfeeding; most mothers introduce solid foods, water, and juice prior or at six months postpartum. Therefore, we estimate a type I Tobit model with left censoring at zero.

To overcome dependence on the assumptions of normality and homoscedasticity, which are essential for the consistency of Tobit estimates, and allow separate mechanisms to determine the participation decision (i.e., whether to initiate breastfeeding) and the amount decision (i.e., duration conditional on breastfeeding being initiated), we estimate two-tier (truncated normal hurdle) models of partial and exclusive breastfeeding duration. The estimates remain consistent even when the strict distributional assumptions of normality and homoscedasticity are relaxed.

## 3. Results

Table 1 summarizes the regression results for the likelihood of breastfeeding initiation using two specifications, the linear probability model and Probit.

Table 2 presents the regression results for the likelihood of exclusive and partial breastfeeding at three and six months postpartum, where the likelihood function is modeled using the linear probability and Probit specifications. Estimation results are consistent across the models and tell a qualitatively similar story about the determinants of breastfeeding persistence. Women who are mature, married, educated, have higher perceived comfort in breastfeeding, had been breastfed as infants, and did not smoke during pregnancy are more likely to breastfeed at three and six months postpartum; a similar conclusion applies for the likelihood of exclusive breastfeeding at three

[3] Out of 1271 observations, 253 are right-censored.

months. The aforementioned factors are highly significant in all three regressions. Additionally, there is some evidence that Caucasian women and those residing in the western region are more likely to breastfeed partially or exclusively at three month, while southern residence is associated with lower likelihood of exclusive breastfeeding at three month. Remarkably, women in higher income families tend to be less likely to breastfeed at six months. This finding can be attributed to the fact that two-earner families are more likely to have higher income, hence women in such families tend to have lower breastfeeding persistence. This hypothesis is consistent with income having a negative effect on breastfeeding duration (see Table 2). Overall, these results are consistent with the previous literature on breastfeeding (Roe et. al., 1999, Chatterji et al., 2002, and Mandal et. al., 2010).

**Table 1.** Peer effects and the likelihood of breastfeeding initiation

| Variable | OLS | Probit |
|---|---|---|
| Knows 1 or 2 friends who breastfed | -0.014 | -0.091 |
| | (0.027) | (0.174) |
| Knows 3 to 5 friends who breastfed | 0.019 | 0.137 |
| | (0.024) | (0.175) |
| Knows more than 5 friends who breastfed | 0.028 | 0.356* |
| | (0.023) | (0.186) |
| Age | 0.001 | 0.006 |
| | (0.001) | (0.011 |
| Married | 0.020 | 0.152 |
| | (0.017) | (0.133) |
| High education | 0.062*** | 0.443*** |
| | (0.022) | (0.138) |
| White | -0.023 | -0.208 |
| | (0.016) | (0.167) |
| South | 0.015 | 0.128 |
| | (0.014) | (0.129) |
| West | 0.021 | 0.211 |
| | (0.014) | (0.163) |
| Mother was ever breastfed | 0.034*** | 0.319*** |
| | (0.012) | (0.118) |
| Mother smoked during pregnancy | -0.017 | -0.132 |
| | (0.029) | (0.186) |
| Family income | 0.002 | 0.018 |
| | (0.002) | (0.034) |
| Contribution of mother's pay to family income | -0.029** | -0.287** |
| | (0.012) | (0.117) |
| Comfort in breastfeeding | 0.039*** | 0.355*** |
| | (0.014) | (0.113) |
| Number of observations | 1521 | 1521 |
| R-squared | 0.048 | 0.107 |
| F-statistic | 3.70 | - |

**Notes:** *, **, and *** indicate statistically significant levels at 10%, 5%, 1%, respectively. Standard errors are in parentheses.

Notably, peer effects only kick in after a critical mass of the prevalence of breastfeeding in a peer group is achieved. Knowing only up to 5 friends of relatives who ever breastfed their babies

does not have a statistically significant effect on the likelihood of partial or exclusive breastfeeding at three months (though having just one or two peers who breastfed has a positive effect on the likelihood of breastfeeding at six month, which is significant at 10% level only). On the other hand, having more than five peers who breastfed is highly significant in all three regressions.

**Table 2.** Peer effects and the likelihood of breastfeeding

| Variable | Breastfeeding at month three | | Breastfeeding at month six | | Exclusive breast-feeding at month three | |
|---|---|---|---|---|---|---|
| | **OLS** | **Probit** | **OLS** | **Probit** | **OLS** | **Probit** |
| Knows 1 or 2 friends who breastfed | 0.021<br>(0.05) | 0.07<br>(0.142) | 0.092*<br>(0.054) | 0.276*<br>(0.158) | 0.03<br>(0.045) | 0.095<br>(0.155) |
| Knows 3 to 5 friends who breastfed | 0.047<br>(0.048) | 0.122<br>(0.134) | 0.074<br>(0.051) | 0.221<br>(0.148) | 0.06<br>(0.043) | 0.195<br>(0.144) |
| Knows more than 5 friends who breastfed | 0.154***<br>(0.046) | 0.499***<br>(0.134) | 0.197***<br>(0.051) | 0.564***<br>(0.147) | 0.166***<br>(0.044) | 0.478***<br>(0.14) |
| Age | 0.011***<br>(0.003) | 0.034***<br>(0.008) | 0.011***<br>(0.003) | 0.031***<br>(0.008) | 0.005**<br>(0.003) | 0.016**<br>(0.008) |
| Married | 0.143***<br>(0.036) | 0.401***<br>(0.101) | 0.176***<br>(0.039) | 0.479***<br>(0.109) | 0.115***<br>(0.032) | 0.373***<br>(0.109) |
| High education | 0.161***<br>(0.04) | 0.47***<br>(0.114) | 0.117***<br>(0.042) | 0.336***<br>(0.121) | 0.14***<br>(0.034) | 0.501***<br>(0.128) |
| White | 0.001<br>(0.039) | 0.007<br>(0.116) | 0.064<br>(0.044) | 0.177<br>(0.123) | 0.129***<br>(0.036) | 0.427***<br>(0.123) |
| South | -0.032<br>(0.03) | -0.099<br>(0.092) | -0.025<br>(0.034) | -0.079<br>(0.095) | -0.057*<br>(0.03) | -0.189**<br>(0.092) |
| West | 0.054<br>(0.031) | 0.199*<br>(0.111) | 0.031<br>(0.037) | 0.093<br>(0.109) | 0.042<br>(0.036) | 0.114<br>(0.102) |
| Mother was ever breastfed | 0.076***<br>(0.026) | 0.23***<br>0.083) | 0.099***<br>(0.03) | 0.275***<br>(0.085) | 0.071***<br>(0.028) | 0.224***<br>(0.081) |
| Mother smoked during pregnancy | -0.198***<br>0.056 | -0.579***<br>(0.161) | -0.14**<br>(0.06) | -0.414**<br>(0.183) | -0.189***<br>(0.042) | -0.717***<br>(0.199) |
| Family income | -0.005<br>(0.007) | -0.019<br>(0.021) | -0.021***<br>(0.008) | -0.061***<br>(0.022) | -0.004<br>(0.007) | -0.011<br>(0.021) |
| Contribution of mother's pay to family income | -0.017<br>(0.026) | -0.062<br>(0.082) | -0.031<br>(0.03) | -0.09<br>(0.083) | -0.067**<br>(0.027) | -0.199**<br>(0.079) |
| Comfort in breastfeeding | 0.129***<br>(0.028) | 0.399***<br>(0.083) | 0.117***<br>(0.031) | 0.325***<br>(0.086) | 0.105***<br>(0.028) | 0.313***<br>(0.084) |
| Number of observations | 1225 | 1225 | 1077 | 1077 | 1225 | 1225 |
| *R*-squared | 0.158 | 0.131 | 0.136 | 0.106 | 0.131 | 0.111 |
| *F*-statistic | 19.54 | - | 15.62 | - | 20.02 | - |
| Likelihood ratio $\chi^2$ | - | 201.67 | - | 156.00 | - | 181.58 |

**Notes:** *, **, and *** indicate statistically significant levels at 10%, 5%, 1%, respectively. Standard errors are in parentheses.

The estimation for the breastfeeding initiation is less precise, which is probably due to a high variation in breastfeeding behavior (persistence and intensity) among women who initiate breastfeeding. High education, having been breastfed as infant, and higher perceived comfort in breastfeeding positively affect breastfeeding initiation (significant at 1% level), while women who are the breadwinners for their families are less likely to initiate breastfeeding (significant at 5% level).

**Table 3.** Peer effects and the duration of partial and exclusive breastfeeding

| Variable | Duration of partial breastfeeding | | | Duration of exclusive breastfeeding | | |
|---|---|---|---|---|---|---|
| | OLS | Two-limit Tobit | Truncated Normal Hurdle | OLS | Two-limit Tobit | Truncated Normal Hurdle |
| Knows 1 or 2 friends who breastfed | 2.608 | 2.790 | 3.511* | 0.516 | 1.478 | -0.003 |
| | (1.841) | (2.419) | (1.932) | (0.619) | (1.589) | (1.166) |
| Knows 3 to 5 friends who breastfed | 2.131 | 2.434 | 1.922 | 0.68 | 1.692 | 1.152 |
| | (1.768) | (2.321) | (1.838) | (0.633) | (1.502) | (1.165) |
| Knows more than 5 friends who breastfed | 9.163*** | 11.481*** | 8.769*** | 2.93*** | 5.479*** | 3.086*** |
| | (1.815) | (2.320) | (1.879) | (0.663) | (1.484) | (1.149) |
| Age | 0.7*** | 0.844*** | 0.720*** | 0.072* | 0.104 | 0.107 |
| | (0.107) | (0.136) | (0.110) | (0.042) | (0.084) | (0.070) |
| Married | 5.273*** | 6.449*** | 5.384*** | 1.596*** | 2.896*** | 2.788*** |
| | (1.344) | (1.723) | (1.394) | (0.473) | (1.093) | (0.832) |
| High education | 6.939*** | 9.517*** | 6.256*** | 2.093*** | 4.717*** | 2.389*** |
| | (1.413) | (1.923) | (1.496) | (0.482) | (1.253) | (0.840) |
| White | 2.169 | 2.535 | 2.681* | 2.25*** | 6.560*** | 0.759 |
| | (1.486) | (1.938) | (1.519) | (0.508) | (1.285) | (0.967) |
| South | -1.741 | -1.977 | -2.118* | -0.58 | -0.797 | -1.450* |
| | (1.239) | (1.562) | (1.274) | (0.486) | (0.967) | (0.764) |
| West | 2.005 | 2.946 | 1.702 | 0.717 | 1.478 | 0.326 |
| | (1.375) | (1.808) | (1.386) | (0.598) | (1.085) | (0.842) |
| Mother was ever breastfed | 3.744*** | 4.931*** | 3.016*** | 0.763* | 1.323 | 0.994 |
| | (1.102) | (1.409) | (1.125) | (0.439) | (0.869) | (0.670) |
| Mother smoked during pregnancy | -8.172*** | -9.628*** | -8.775*** | -1.140* | -0.505 | -2.539** |
| | (1.847) | (2.557) | (1.980) | (0.642) | (1.628) | (1.061) |
| Contribution of mother's pay to family income | -1.551 | -2.222 | -0.573 | -0.644 | -1.172 | -0.301 |
| | (1.081) | (1.381) | (1.108) | (0.434) | (0.845) | (0.664) |
| Family income | -0.522* | -0.787** | -0.638** | -0.075 | -0.143 | 0.105 |
| | (0.286) | (0.361) | (0.287) | (0.112) | (0.220) | (0.162) |
| Comfort in breast-feeding | 5.921*** | 7.825*** | 5.188*** | 2.381*** | 5.174*** | 2.181*** |
| | (1.119) | (1.425) | (1.158) | (0.421) | (0.907) | (0.709) |
| Number of observations | 1271 | 1271 | 1184 | 1483 | 1483 | 717 |
| R-squared | 0.207 | 0.031 | 0.194 | 0.104 | 0.024 | 0.120 |
| F-statistic | 31.18 | - | - | 14.79 | - | - |

**Notes:** *, **, and *** indicate statistically significant levels at 10%, 5%, 1%, respectively. Standard errors are in parentheses.

Table 3 summarizes the estimation results for the duration of partial and exclusive breastfeeding. OLS estimation suggests that, again, mature age, education, being married, having been breastfed as infant, higher perceived comfort in breastfeeding, and no prenatal smoking positively affect breastfeeding duration, both exclusive and partial. Higher income is associated with abbreviated duration of partial breastfeeding, although the level of significance is only 10%.

Two-limit Tobit, which accounts for upper and lower censoring at zero and 52 weeks, respectively, produces similar results. To allow separate mechanisms to determine the participation decision (initiation of partial or exclusive breastfeeding) and the amount decision (duration conditional on breastfeeding being initiated), we also estimate truncated normal hurdle models. The estimates for the amount decision are comparable to OLS and Tobit estimates, and are also reported in Table 3.

The character of peer effects for breastfeeding duration resembles that for the likelihood of breastfeeding. Again, peer influences are only significant after the prevalence of breastfeeding in a peer group reaches some critical level. Knowing up to 5 friends or relatives who breastfed generally does not seem to have a significant effect on breastfeeding duration, while having more than five peers who breastfed has a highly significant positive effect in all six models. We report estimates for the participation decision (which can be interpreted as the likelihood of initiating partial or exclusive breastfeeding) in Table 4. As expected, the estimates generally conform to the OLS and Probit estimates reported in Table 1.

**Table 4.** Estimates for the participation equation of the truncated normal hurdle models

| Variable | Breastfeeding duration | Exclusive breastfeeding duration |
|---|---|---|
| Knows 1 or 2 friends who breastfed | -0.079 | 0.135 |
| | (0.178) | (0.124) |
| Knows 3 to 5 friends who breastfed | 0.133 | 0.102 |
| | (0.180) | (0.118) |
| Knows more than 5 friends who breastfed | 0.356* | 0.335*** |
| | (0.191) | (0.117) |
| Age | 0.006 | 0.003 |
| | (0.012) | (0.007) |
| Married | 0.137 | 0.116 |
| | (0.138) | (0.087) |
| High education | 0.440*** | 0.313*** |
| | (0.142) | (0.099) |
| White | -0.165 | 0.536*** |
| | (0.173) | (0.099) |
| South | 0.133 | 0.004 |
| | (0.133) | (0.078) |
| West | 0.209 | 0.116 |
| | (0.168) | (0.090) |
| Mother was ever breastfed | 0.308** | 0.069 |
| | (0.122) | (0.070) |
| Mother smoked during pregnancy | -0.094 | 0.134 |
| | (0.191) | (0.131) |
| Contribution of mother's pay to family income | -0.299** | -0.086 |
| | (0.120) | (0.069) |
| Family income | 0.027 | -0.017 |
| | (0.035) | (0.018) |
| Comfort in breastfeeding | 0.326*** | 0.357*** |
| | (0.116) | (0.072) |
| Number of observations | 1271 | 1483 |
| Likelihood ratio $\chi^2$ | 65.13 | 112.71 |

**Notes:** *, **, and *** indicate statistically significant levels at 10%, 5%, 1%, respectively. Standard errors are in parentheses.

It is remarkable that the mother having been breastfed as infant has a very significant positive effect in most models (although the effect tends to be less significant for exclusive breastfeeding compared to partial). This finding also agrees with the previous results in the literature (Mandal et al., 2010) and has important policy implications. Our results may help explain why, despite active public health campaigns aimed at the breastfeeding promotion, the prevalence of breastfeeding remains modest. The regression results reveal the presence of significant inter-generational transmission of breastfeeding behavior. The latter occurs when breastfeeding decisions of the younger generation are influenced by breastfeeding behavior of the older generation. Such a phenomenon may be observed due to social norms, discouragement/ encouragement, advice, transfer of knowledge, or help with breastfeeding that comes from the older generation. Controlling for exogenous factors that affect breastfeeding, women who had been breastfed as infants are more likely to breastfeed their infants, and vice versa. Therefore, it is reasonable to expect that low breastfeeding rates among women who *had their children* in the 1970's would have a lagged effect on the breastfeeding rates among women who were *born* in the 1970's. In contrast, peer effects could reflect either intra- or inter-generational effects, depending on the composition of peer groups. Intra-generational effects are observed when transmission of breastfeeding behavior occurs within the same generation. In our paper, we find evidence of both inter- and intra-generational effects in breastfeeding.

## 4. Conclusions

We studied the role of peer influences on the initiation and duration of breastfeeding (both partial and exclusive), and the likelihood of breastfeeding at three and six months postpartum. Although different in magnitude, the peer effects are qualitatively very similar in all regressions. For the peer effects to become significant, the prevalence of breastfeeding in a peer group has to reach a certain minimum level, or "critical mass". Knowing less than five friends or relatives that ever breastfed generally does not have a significant effect on breastfeeding decisions, although there is a weak evidence that having just one or two peers who breastfed may have a positive effect on breastfeeding duration and breastfeeding past six months. On the other hand, having more than five peers who breastfed has a highly significant positive effect on breastfeeding persistence and duration of partial and exclusive breastfeeding.

The results suggest the presence of a social multiplier in breastfeeding, which has important policy implications. Any exogenous change in breastfeeding behavior due to, for instance, policy interventions would result in an even greater change due to the bidirectional influences within peer groups. Hence, there is a positive externality associated with breastfeeding. Existence of a positive externality typically results in an under-provision of the good (breastfeeding). Therefore, a Pigovian subsidy may be needed to promote breastfeeding and correct for the externality.[4] Note, however, that the scope of social multiplier could be either amplified or moderated by inter-generational transmission of breastfeeding behavior. This may help explain why, despite active public health campaigns aimed at promoting breastfeeding, the prevalence of breastfeeding in the U.S. remains modest.

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[4] We thank an anonymous referee for pointing us to this observation.

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