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Does Contraceptive Use Always Reduce Breast-feeding?

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Abstract Previous studies suggest that access to modern contraceptives can reduce breast-feeding rates because women who had been using breast-feeding to avoid pregnancy substitute away from it. This article shows that contraceptive use can also have a positive effect on breast-feeding. A mother often weans a child if she becomes pregnant again, which can occur sooner than desired if she lacks access to contraceptives. Thus, by enabling longer birth spacing and preventing unwanted pregnancies, contraceptive use allows for a longer duration of breast-feeding. This positive effect should primarily affect infants who are past the first few months of life because their mothers are more fecund then, and the negative effect should affect infants who are very young because the contraceptive property of breast-feeding is strongest then. I test for these dual effects using Demographic and Health Survey data for Indonesia. I find evidence of the positive birth-spacing effect: contraceptive use increases the likelihood that children continue to be breast-fed past age 1. There is also suggestive evidence of a negative substitution effect among infants age 3 months and younger.

Keywords Breast-feeding · Contraception · Family planning · Birth spacing

Introduction

Breast-feeding temporarily reduces a woman's *fecundity*, the physiological ability to become pregnant (Blackburn 2007). In many developing countries, women have limited access to family planning (FP) services, and breast-feeding therefore helps them to prevent or delay pregnancies. One implication is that modern contraception could crowd out breast-feeding by eliminating one of its benefits. Indeed, Rous (2001) found evidence in the Philippines that women substitute modern contraception for breast-feeding. Thus, FP programs could have a negative unintended consequence of reducing the rate of breast-feeding. This effect could be detrimental to child health,

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given that the benefits of breast-feeding for children in developing countries are believed to be sizable (Bhutta et al. 2008; Jones et al. 2003).

However, there is also a second link between breast-feeding and fertility that could lead to the opposite effect: access to FP might crowd in, or increase, breast-feeding. Subsequent pregnancies and births are often what trigger mothers to wean their children. Therefore, by enabling mothers to space births further apart, FP services could allow them to breast-feed longer.

Thus, mothers' better FP access will reduce the duration of breast-feeding for some children because of the substitution effect but will increase the duration of breast-feeding for other children because of the birth-spacing effect. One important difference between the two effects is their timing. The substitution effect should be strongest when the nursing child is very young because the extent to which breast-feeding suppresses fecundity declines with the duration of breast-feeding. The birth-spacing effect, in contrast, should matter more at later ages, when it is feasible for a mother to become pregnant or give birth again.

This article tests for these dual crowd-out and crowd-in effects in Indonesia. I examine how contraceptive use affects the likelihood that a child is breast-fed and how the effect varies with the child's age. The empirical strategy uses FP information in the mother's community as a source of variation in contraceptive use. Specifically, I use a community-level average of whether mothers received FP information from the media or through visits from an FP worker as an instrumental variable for contraceptive use. This measure of FP information is highly predictive of contraceptive use.

I then examine the effect of contraceptive use on breast-feeding, making use of the predicted dominance of the substitution effect at young ages and the birth-spacing effect at later ages. I find that contraceptive use increases the breast-feeding rate among children older than 1 year, consistent with the birth-spacing effect. I confirm that birth spacing is the mechanism by showing that FP information leads to fewer births, with an age profile similar to that of the breast-feeding effects. I also find suggestive evidence of the negative substitution effect for young children; contraceptive use appears to reduce breast-feeding of children 3 months old and younger, although this finding is not statistically significant.

These results indicate that the effect of contraceptive use on breast-feeding is more nuanced than conventional wisdom might suggest. Although access to contraceptives could have the negative unintended consequence of reducing the duration of breast-feeding for some children, it also increases the duration of breast-feeding for other children by preventing or delaying subsequent births. In contexts where mothers have a strong desire to breast-feed for reasons other than its effect on fecundity—perhaps because of successful campaigns to promote breast-feeding, as in Indonesia—the positive unintended consequence could in fact be stronger. Without access to contraceptives, many women would have to stop breast-feeding earlier than desired because of an unplanned pregnancy. With access to contraceptives, however, they can continue breast-feeding longer, as seen in Indonesia. Of note is that although the positive birth-spacing effect is considerably larger in magnitude than the negative substitution effect in this context, breast-feeding at young ages likely confers greater health benefits. Thus, the overall effect of contraceptive use on child health via the channel of breast-feeding could be either positive or negative.

The remainder of the article is organized as follows. The following section discusses the hypotheses I test. Then I describe the data and present descriptive statistics for the sample. Next, I describe the empirical strategy used to estimate the effects of contraception on breast-feeding, present the empirical results, and then conclude.

Hypotheses

Mechanisms Linking Breast-feeding and Contraception

Contraceptive Effect of Breast-feeding

Breast-feeding reduces fecundity by affecting the production of certain reproductive hormones. The exact mechanisms are not fully understood, but breast-feeding is known to suppress the production of gonadotropin-releasing hormone (GRH) and follicle-stimulating hormone (FSH). The release of these hormones is part of what triggers ovulation. Breast-feeding also leads to increased levels of *prolactin*, a hormone that inhibits ovulation (Blackburn 2007). Even when a woman ovulates, her likelihood of conceiving is lower if she is breast-feeding.

In addition, nursing imposes a high caloric demand on a mother, and if she does not increase her food intake sufficiently—as often is the case in developing countries—she can become underweight and undernourished. Such breast-feeding–induced malnourishment can interfere with ovulation.[1]

The extent to which breast-feeding inhibits fecundity decreases with the duration of breast-feeding. According to the World Health Organization (WHO), breast-feeding reliably prevents pregnancy only during the first sixth months after delivery. Fertility is suppressed more if the mother breast-feeds more times per day and if the child suckles more intensely. The fact that the daily frequency of nursing decreases after solid food is introduced to an infant may be one reason why fertility suppression associated with nursing declines with the duration of nursing. Many studies find that the period of reduced fertility is longer in developing countries, perhaps because of mothers' malnourishment (Huffman et al. 1987; Weis 1993).

If mothers are aware of the link between breast-feeding and fecundity, one reason they may choose to breast-feed is to prevent or delay becoming pregnant. In the Indonesia Demographic and Health Survey (DHS) data I use in the analysis, 18 % of mothers who are not using modern contraceptives cite breast-feeding as the reason, suggesting that at least some women are aware of the link. Because breast-feeding typically leads to amenorrhea (suspension of menses), women may realize that they are less fecund while breast-feeding even if they never formally learn about the link.[2]

The implication of this link is that contraceptive use could have a negative effect on the rate of breast-feeding. Rous (2001) tested for several signatures of this substitution effect, using the Cebu Longitudinal Health and Nutrition Survey from the Philippines. He found that women who report knowing the contraceptive effects of breast-feeding are more likely to breast-feed, and women whose spouse is currently not living with

[1] Another reason why breast-feeding reduces fertility (but not fecundity) in some societies is if there is a taboo against sexual intercourse for a nursing mother (Bleek 1976).

[2] Estrogen-containing contraception can reduce the amount of breast milk, which is another way in which contraception can cause a decline in breast-feeding, even without the mother's awareness (Kelsey 1996).

them (so who presumably have sexual intercourse less frequently) are less likely to breast-feed. In addition, breast-feeding decreases after the return of menses. A few signatures of the substitution hypothesis are absent from the data: for example, neither a higher price of contraception nor a greater travel distance to acquire contraceptives leads to increased breast-feeding.[3]

Subsequent Fertility as a Cause of Weaning

A second link between breast-feeding and fertility arises because subsequent conceptions and births affect a mother's decision to continue breast-feeding a child. According to the American Academy of Family Physicians (2008), breast-feeding while pregnant is not harmful to the fetus, but some studies suggest that it could increase the likelihood of miscarriages (Verd et al. 2008). Similarly, the medical profession does not discourage breast-feeding two children at once, but research finds that infant weight gain is slowed if a mother is simultaneously nursing an older sibling (Marquis et al. 2002). Some evidence suggests that breast milk production declines during pregnancy and that the taste of the breast milk changes, both of which might hasten weaning (Feldman 2000). In developing countries, meeting the caloric requirements of breast-feeding two children or breast-feeding while pregnant is likely more difficult than it would be for the mothers in the aforementioned studies.

The reason why mothers stop breast-feeding after a conception or birth need not be related to her milk production or concerns about the younger child's health. For example, she could simply be busier or more tired and could choose to wean the older child as a result. Regardless of the underlying motivation, in the Indonesia DHS data, 21 % of respondents cite becoming pregnant or giving birth as the reason why they stopped nursing their child.

Jayachandran and Kuziemko (2011) found evidence suggestive of this birth-spacing mechanism in India. The probability that a child is being breast-fed is lower in families that want to have another child quickly (e.g., families with no sons). This lower rate of breast-feeding is seen for children as old as age 2 years. Because fecundity has largely returned to normal levels by the time the child reaches this age, the main mechanism for lower rates of breast-feeding in these families seems to be that the mother became pregnant or gave birth again, which prompted her to stop nursing the child.

Predictions About the Effect of Contraception on Breast-feeding for Younger and Older Children

This section derives predictions about how access to contraceptives will affect the rate of breast-feeding for younger and older children. Consider two time periods (age ranges) when a child can be breast-fed: young and old. Young children are defined as those younger than 1 year, and older children are between 1 and 2 years old. A key distinction between the two periods is that breast-feeding makes the mother infertile when her child is young but not when the child is old. This assumption is a stylized way

[3] For other research on the negative relationship between contraceptive use and breast-feeding, see Jain and Bongaarts (1981), Zurayk (1981), Millman (1985), Meredith et al. (1987), Salway (2001), and Becker and Ahmed (2001).

of modeling the fact that the degree to which breast-feeding suppresses fecundity declines with the child's age.[4]

Mothers vary in how much they value breast-feeding aside from its contraceptive properties, which could be due to different perceptions of the health benefits that breast-feeding confers on their child, the quality of the alternative food they would feed their child, how much they enjoy nursing their child, or their opportunity costs of breast-feeding. For simplicity, consider two types of mothers: (1) those for whom breast-feeding *per se* provides net benefits, and (2) those for whom it entails small net costs.[5] The first type wants to breast-feed during both periods (i.e., until her child is 2 years old) even without factoring in the benefit of her reduced fecundity. The second type does not want to breast-feed her child in either period, absent FP considerations.

I assume that mothers wish to space their births sufficiently far apart that even when their child is a toddler, they prefer to delay pregnancy.[6] A mother who is breast-feeding a young child will not become pregnant. Similarly, a mother who is using contraceptives in either period will not become pregnant. Otherwise, there is some probability that she will become pregnant. If a woman becomes pregnant during a time period, the pregnancy triggers her to stop breast-feeding if she had been breast-feeding at that point.

I will compare two regimes: one where FP is available, and one where it is not. When FP is available, I assume that a mother can obtain and use contraceptives without cost. Of course, in practice, using contraceptives is not without costs, but abstracting from them does not change the predictions.

This set of assumptions implies two predictions about how access to FP affects breast-feeding. First consider young children (infants). When no FP access exists, both types of mothers will breast-feed a young child. The net-benefit mothers receive two benefits: they value breast-feeding *per se*, and breast-feeding acts as a substitute for contraceptives. The net-cost mothers will breast-feed because of the contraceptive benefit. However, when contraceptives become available, the two types of mothers will diverge in their choices. The net-benefit mothers will continue to breast-feed because they value doing so for reasons aside from its contraceptive effect, but the net-cost mothers will no longer breast-feed because they can use modern contraceptives to prevent pregnancy. The switching behavior of the second type of mother yields the following prediction:

> **Prediction 1.** *Access to family planning, by increasing contraceptive use, reduces the average rate of breast-feeding for young children ("substitution effect").*

Next consider older children (toddlers). At this age, the effect of breast-feeding on the mother's fecundity is relatively negligible. Regardless of whether contraceptives are available, the net-cost mothers will not breast-feed because it confers no benefit to

[4] In actuality, breast-feeding does not make a woman completely infertile during the first year, and it still reduces fertility to some degree after the first year.

[5] Modeling two types rather than a continuum of preferences captures the essential difference between mothers who want to breast-feed *per se* and those for whom the contraceptive properties are dispositive in their decision to breast-feed. Some women with a sufficiently high cost of breast-feeding would not breast-feed even though they value its contraceptive property; these women would not breast-feed in either time period, regardless of the availability of contraception.

[6] In reality, some mothers will want to have a shorter birth interval; the predictions presented here are applicable to those mothers who want to space births relatively far apart.

them. Net-benefit mothers would like to breast-feed. However, when contraceptives are unavailable, some mothers will have become pregnant and so are unable to breast-feed. When contraceptives are available, everyone will take advantage of them and subsequent pregnancies will be delayed. Now all net-benefit mothers will be able to breast-feed their older children. The availability of contraceptives does not change net-cost mothers' decision not to breast-feed older children, but it increases how long net-benefit mothers can breast-feed:

> **Prediction 2.** *Access to family planning, by increasing contraceptive use, increases the average rate of breast-feeding for older children ("birth-spacing effect").*

I now turn to describing the data that I will use to test these two predictions.

Data, Descriptive Statistics, and Indonesian Context

The empirical analysis focuses on Indonesia, a country with a relatively high rate of both contraceptive use and breast-feeding. The Indonesian government FP efforts, carried out by the National Family Planning Coordinating Board (BKKBN), are lauded as a success story of FP interventions. Since the 1970s, BKKBN has promoted contraceptive use and smaller family size through *inter alia* volunteer FP field workers and media campaigns to promote demand for contraceptives. In tandem, supply-side improvements were seen, and contraceptives became quite widely available (Hugo et al. 1995). Previous research finds that BKKBN programs indeed had a positive impact on contraceptive use in Indonesia (Frankenberg et al. 2003; Lerman et al. 1989). In terms of breast-feeding, among the 15 low-income and middle-income countries in Africa, Latin America, and Asia compared by Grummer-Strawn (1996), Indonesia had the highest average duration of breast-feeding (at 27 months).

The data I use are from the Demographic and Health Surveys (DHS) for Indonesia for 1994, 1997, 2002, and 2007. A representative sample of ever-married women aged 15–49 was interviewed in each wave. The DHS data are well suited for the analysis because women are asked about topics that include childbearing, breast-feeding, use of family planning, and their information sources on FP.

My hypotheses apply to many settings, and DHS data are available for many countries. I focus on Indonesia for two main reasons. First, the DHS questionnaires and sampling strategy for Indonesia allow for a large sample size. Four recent DHS data sets offer consistent questions on FP information, and data are collected for three channels (radio, television, and FP workers). Although there are no longitudinal data on the same women, being able to pool multiple surveys generates a large sample size. In addition, there are many primary sampling units (PSUs) per wave, and because the independent variable varies at this level, having many PSUs is useful for statistical power.[7]

The second reason I focus on Indonesia is that its government FP initiatives, described earlier, generate considerable variation in information about and use of contraceptives. Ross and Frankenberg (1993) reported that much of the unmet need

[7] The two pre-1994 DHS waves for Indonesia lack the same data on FP information; the four waves used are the largest set with consistent data on FP information.

for contraception in Indonesia is among postpartum women who wish to space births at least two years apart, and this article focuses on precisely this group. Thus, Indonesia is a setting where geographic and temporal variation in FP information provides a useful source of variation in contraceptive use for the population of interest.

The sample I use comprises children who are alive at the time of the survey, are age 24 months and younger, and reside with their mother.[8] I require that the key variables (the main dependent variable—whether the child is currently being breast-fed—and the independent variables) are nonmissing. This yields a sample size of 25,785 children.

Table 1 presents summary statistics, separately for children age 3 months and younger, 4–6 months, 7–12 months, and 13–24 months. In the empirical analysis, I use these age categories to examine how the effects of contraceptive use on breast-feeding vary with the child's age. The rationale for dividing the first year of life into smaller age categories is that the substitution effect might be pronounced at only very young ages, when breast-feeding most strongly inhibits fecundity.

As expected, the proportion of children being breast-fed declines with age. About 96 % of children below age 3 months are breast-fed, declining to 72 % for 13- to 24-month-olds. Meanwhile, mothers' use of contraceptives increases with the time since their last birth. Among mothers of children younger than 3 months, 20 % use modern contraceptives, with the rate increasing to 64 % for mothers of children older than 1 year. This increase is consistent with at least some mothers being aware that breast-feeding has contraceptive effects or with a lower rate of sexual intercourse in the first months after childbirth.

Table 1 also shows the patterns of subsequent fertility, both whether the mother is pregnant (or more precisely, knows and reports that she is pregnant) and whether she has had another child. I also construct a variable that combines these two possibilities: a dummy variable for either being pregnant or having had another child. Among children age 7–12 months, 2 % have a mother who is pregnant or who had another child, with the rate increasing to 7 % in the age range of 13–24 months.

Table 2 presents some preliminary evidence in support of the hypotheses. The table shows the correlation between whether a child is being breast-fed and whether her mother is using contraceptives, separately for the different age categories. Consistent with contraception crowding out breast-feeding at young ages, the correlation is negative for children younger than 12 months; this correlation, however, is statistically significantly negative only during the first six months, which is when breast-feeding most strongly inhibits fecundity. For children older than 1 year, the correlation becomes statistically significantly positive, consistent with contraceptive use leading to an increase in breast-feeding. Note that these correlations cannot be interpreted as causal because both contraceptive use and breast-feeding are choices a mother makes, and the correlation could be driven by reverse causality or a third factor, such as the mother's education level or employment status. The empirical analysis will examine the causal effect of contraceptive use on breast-feeding by isolating exogenous variation in contraceptive use. Nonetheless, because *a priori* one would not expect omitted

[8] A child is defined as, say, 7 months old if she is strictly more than 6 months (or roughly 183 days) old but less than or equal to 7 months (or roughly 213 days) old. The age in months is calculated using the year, month, and day of the child's birth as well as the month and year of the interview. The day of the interview is treated as the 15th. If the birth month and year are available but the day is not, I impute the day of birth as the 15th.

Table 1 Summary statistics (sample means, with standard deviations in parentheses)

	Age ≤ 3 Months	Age 4–6 Months	Age 7–12 Months	Age 13–24 Months
Currently Breast-feeding	0.963	0.936	0.875	0.715
	(0.188)	(0.245)	(0.331)	(0.452)
Contraceptive Use	0.204	0.503	0.598	0.636
	(0.403)	(0.500)	(0.490)	(0.481)
Currently Pregnant	0.000	0.001	0.019	0.053
	(0.000)	(0.024)	(0.138)	(0.223)
Child Has Younger Sibling	0.000	0.000	0.001	0.020
	(0.000)	(0.000)	(0.032)	(0.141)
Mother Is Pregnant or Child Has Younger Sibling	0.000	0.001	0.020	0.073
	(0.000)	(0.024)	(0.142)	(0.259)
Heard About FP on Radio Last 6 Months (PSU)	0.196	0.193	0.199	0.205
	(0.248)	(0.250)	(0.251)	(0.256)
Heard About FP on TV Last 6 Months (PSU)	0.373	0.366	0.373	0.376
	(0.327)	(0.330)	(0.330)	(0.331)
Visited by FP Worker Last 6 Months (PSU)	0.183	0.198	0.200	0.207
	(0.247)	(0.266)	(0.270)	(0.274)
Any FP Info From TV, Radio, or FP Worker (PSU)	0.502	0.503	0.510	0.517
	(0.332)	(0.334)	(0.335)	(0.337)
Any FP Info (nonsample women in PSU)	0.470	0.469	0.476	0.481
	(0.265)	(0.264)	(0.267)	(0.267)
Listens to Radio Daily (PSU)	0.364	0.362	0.359	0.366
	(0.319)	(0.320)	(0.322)	(0.321)
Watches TV Weekly (PSU)	0.688	0.693	0.700	0.701
	(0.338)	(0.342)	(0.340)	(0.338)
Rural	0.677	0.678	0.662	0.668
	(0.468)	(0.467)	(0.473)	(0.471)
Wealth Index	0.601	0.596	0.603	0.597
	(0.281)	(0.290)	(0.289)	(0.290)
Mother's Education Secondary or Higher	0.481	0.480	0.487	0.461
	(0.500)	(0.500)	(0.500)	(0.498)
Any Prenatal Care	0.954	0.954	0.965	0.966
	(0.209)	(0.210)	(0.184)	(0.182)
Child Given Any Vaccine	0.422	0.788	0.868	0.893
	(0.494)	(0.409)	(0.338)	(0.309)
Gave Birth at Home	0.688	0.682	0.674	0.699
	(0.463)	(0.466)	(0.469)	(0.459)
Observations	3,594	3,579	6,352	12,260

Notes: Each observation is a child aged 24 months or younger who is alive at the time of the survey. N = 25,785. Variables with "(PSU)" in the name are averages within the PSU, excluding the respondent.

Table 2 Correlation between contraceptive use and breast-feeding

	Age ≤ 3 Months	Age 4–6 Months	Age 7–12 Months	Age 13–24 Months
Correlation Coefficient	–.048	–.072	–.014	.097
p Value	<.01	<.01	.26	<.01

Note: Each column reports the correlation between whether the child is being breast-fed and whether the mother is using modern contraception at the time of the survey for the subsample of children in the age range indicated in the column heading.

variables to exhibit such a strong gradient in the child's age, even these raw correlations are quite striking.

The empirical analysis uses the availability of information about FP as the identifying source of variation in contraceptive use and, in turn, breast-feeding. The Indonesian DHS data have consistent measures for three sources of FP information: hearing about it on the radio, seeing a message on television, and being visited by a FP worker. In the analysis, I use the proportion of women who receive FP information from at least one source as the measure of FP information in the community. Contraceptive use is determined by both supply and demand factors, and the goal of using FP information is to isolate supply-driven variation (Pritchett 1994). To further isolate the supply component, I use the mean value of the FP information in the woman's geographic area (PSU), excluding herself. I also show the robustness of the results to constructing the FP information variable based on women not in the analysis sample.

The next rows of Table 1 show the summary statistics for the control variables used. First, those who listen to the radio or watch television more often will be more likely to hear about FP, so these are included as control variables. In addition, I include a dummy variable for rural households; a dummy variable for the mother having at least some secondary school; and a wealth index constructed as the mean of dummy variables for having electricity, a radio, a motor vehicle, and a nondirt floor, which are the four consistent wealth proxies across the three surveys. When constructing the index, I replace a missing value for dummy variable with the sample mean. In robustness checks, I also include an extended set of control variables that are measures of other health behaviors by the mother: prenatal care, delivering the child at home, and vaccinating the child. Although including these health behaviors as control variables might be seen as overcontrolling, the robustness of the results to including these control variables provides reassurance that the results are not being driven by omitted variables.

In Table S1 of Online Resource 1, I report the summary statistics by survey wave rather than child's age. There are about 1,200 to 1,500 PSUs per wave and about six women in the sample per PSU. The table also shows which methods of contraception are used in this setting. Injectables and oral contraceptives are the most common forms of contraception.

Empirical Strategy

This section describes the empirical strategy used to test for the effects of contraceptive use on breast-feeding. Breast-feeding and contraceptive use are determined jointly by the mother, so one cannot simply estimate a regression model with breast-feeding as the dependent variable and contraceptive use as the independent variable. For example, educated mothers could be more likely to use contraceptives because they have lower desired fertility and could also be less likely to breast-feed because of a higher opportunity cost of their time, generating a spurious correlation between the two variables (Kim 2010).

Instead, I use plausibly exogenous variation in access to contraceptives as a predictor of contraceptive use. In particular, I use an instrumental variables strategy with exposure to information about FP, which should increase a woman's knowledge of and the salience of modern contraception, as the instrument for contraceptive use. To isolate the supply of contraceptives rather than the demand for them, I use the PSU-average of FP information (constructed excluding the respondent herself).

The first-stage equation measures the relationship between FP information (denoted *InfoFP*) and contraceptive use (denoted *UsesFP*):

$$UsesFP_i = \gamma \cdot InfoFP_i + \boldsymbol{\delta}\mathbf{X}_{ij} + \varepsilon_{ij}. \tag{1}$$

The subscript i denotes the mother, and j denotes the child. The prediction is $\gamma > 0$ because more information should increase take-up of contraception. The standard errors are clustered at the PSU level because *InfoFP* is largely an aggregate measure for the PSU. It varies within PSU only because the respondent herself is excluded when the PSU-level mean is calculated. I estimate Eq. (1) as a linear probability model (ordinary least squares, OLS) (Angrist and Pischke 2008).

Of course, the amount of information about FP that is received could also be partly measuring demand for FP or omitted factors. For example, FP programs could be targeted at high-fertility areas where policy makers perceive low demand for FP—or alternatively, at areas with strong demand for the information (Molyneaux and Gertler 2000; Pitt et al. 1993). Thus, I also include an extensive set of control variables **X**. First, the controls include dummy variables for each combination of survey wave (four waves), geographic region (11 islands), and the age of the child (four age categories). The analysis, hence, is making comparisons among, for example, children age 3 months and younger surveyed in 2002 on the island of Bali, who vary in their mother's access to FP information. Second, I control for the PSU average of the frequency of listening to the radio and watching television, given that these are two of the media for the transmission of FP information. In addition, I control for a wealth index, mother's education, and a dummy variable for rural.[9]

In some specifications, I broaden the set of control variables to include other health behaviors. These additional controls help address the concern that places that receive FP information might also be places that receive more health information, which could affect the propensity to breast-feed. For example, the health workers who promote contraceptive use might also promote prolonged breast-feeding. Because efforts to encourage prolonged breast-feeding would likely be part of a broader package that also encourages other health-promoting behaviors, I address this concern by controlling for other behaviors that promote infant health: namely, receiving prenatal care, giving

[9] In analyses reported in the Online Resource 1, I examine the correlation between the control variables and FP information. *InfoFP* is positively correlated with the PSU's level of development—in particular, with the PSU's average frequency of listening to the radio and watching television.

birth at a health facility, and vaccinating the child. I consider the preferred specification to be the one without these extended controls because these health behaviors are themselves outcomes.

To examine the effects of contraceptive use on breast-feeding, I estimate an equation in which the outcome variable is whether the child is being breast-fed (*BF*) and the main regressor is *UsesFP*. I estimate the model using two-stage least squares (2SLS), instrumenting for *UsesFP* with *InfoFP.*

$$BF_i = \beta \cdot UsesFP_i + \boldsymbol{\delta}\mathbf{X}_{ij} + \varepsilon_{ij}. \tag{2}$$

The hypothesis is that the average effect, $\boldsymbol{\beta}$, will combine the offsetting substitution and birth-spacing effects, and the main objective of this article is to tease out these offsetting effects. Therefore, I examine the effects for children of different ages by including interactions of the independent variables with dummy variables for the child's age:

$$\begin{aligned} BF_{ij} = {} & \boldsymbol{\beta}_1 UsesFP_i + \left(\boldsymbol{\beta}_2 UsesFP_i \times Age4to6_j\right) + \left(\boldsymbol{\beta}_3 UsesFP_i \times Age7to12_j\right) \\ & + \left(\boldsymbol{\beta}_4 UsesFP_i \times Age13to24_j\right) + \boldsymbol{\delta}_1 \mathbf{X}_{ij} + \left(\boldsymbol{\delta}_2 \mathbf{X}_{ij} \times Age4to6_j\right) \\ & + \left(\boldsymbol{\delta}_3 \mathbf{X}_{ij} \times Age7to12_j\right) + \left(\boldsymbol{\delta}_4 \mathbf{X}_{ij} \times Age13to24_j\right) + \varepsilon_{ij}. \end{aligned} \tag{3}$$

The coefficient $\boldsymbol{\beta}_1$ is the effect of contraceptive use for the omitted age group, children age 3 months and younger. The coefficient $\boldsymbol{\beta}_2$ is the differential effect for those age 4–6 months, and so forth. The predictions are (1) that $\boldsymbol{\beta}_1$ will be negative because the substitution effect will be strong for young ages when breast-feeding reduces fecundity, and (2) that at a certain point, the interaction terms $\boldsymbol{\beta}_2$, $\boldsymbol{\beta}_3$, or $\boldsymbol{\beta}_4$ will become positive when the birth-spacing effect kicks in. In the specifications with age interactions, all control variables are also interacted with the age dummy variables. Equation (3) is the main specification used to examine the substitution and birth-spacing effects of contraceptive use on breast-feeding.

Results

Effects of Family Planning Information on Contraceptive Use

As shown in Table 3, FP information indeed causes an increase in contraceptive use; in other words, there is a strong first stage. Column 1 is the specification without controls except for age dummy variables, and the coefficient on FP information is 0.163. Column 2 is the main specification, and controls for several factors that could be correlated with FP information and affect contraceptive use. The coefficient in this specification is 0.126 and highly significant. The effect size implies that contraceptive use is 12.6 percentage points higher when FP information is available to everyone in the PSU compared with when it is available to no one. Column 3 includes additional control variables—specifically, other health-seeking behaviors of the mother—and the coefficient is quite stable (0.113).

The next three columns examine whether there are heterogeneous effects based on the child's age. There is not a strong hypothesis about how the effect of FP information on contraceptive use should vary with the child's age, but I show these specifications because these will be the first-stage equations when examining how contraceptive use affects breast-feeding at different ages. As seen in the summary statistics table, contraceptive use is lower for the first few months after childbirth, consistent with women taking up contraception after the return of menses. Columns 4–6 of Table 3 show that correspondingly, the effect of FP information on the mother's contraceptive use increases after the first three months. It is fairly steady between age 4 and 24 months, as seen by the similar interaction coefficients for age 4–6 months, age 7–12 months, and age 13–24 months.

Validity of the Instrumental Variables Strategy

The results in Table 3 suggest that the FP information is a valid source of variation in contraceptive use. First, there is a strong positive effect of FP information on use of modern contraceptives. Second, the quite consistent results between columns 2 and 3

Table 3 Effect of FP information on contraceptive use (first stage)

	Contraceptive Use					
	(1)	(2)	(3)	(4)	(5)	(6)
FP Info	0.163**	0.126**	0.113**	0.131**	0.075**	0.057*
	(0.012)	(0.012)	(0.012)	(0.021)	(0.023)	(0.022)
FP Info × Age 4–6 Months				0.067*	0.086*	0.084*
				(0.033)	(0.035)	(0.034)
FP Info × Age 7–12 Months				0.010	0.058†	0.064*
				(0.029)	(0.030)	(0.030)
FP Info × Age 13–24 Months				0.043†	0.052*	0.061*
				(0.025)	(0.026)	(0.025)
Observations	25,785	25,785	25,785	25,785	25,785	25,785
R^2	.10	.19	.20	.10	.19	.20
Controls, Basic	No	Yes	Yes	No	Yes	Yes
Controls, Extended	No	No	Yes	No	No	Yes

Notes: Standard errors, clustered by PSU, are in parentheses. FP info is the PSU mean among sample women (excluding the respondent) of a dummy variable for receiving information from any of the three possible FP information sources: radio, television, and FP worker. All regressions include dummy variables for the child's age category: ≤3 months, 4–6 months, 7–12 months, or 13–24 months. The basic set of control variables includes dummy variables for each combination of the survey wave and the island on which the PSU is located, rural, and the mother having at least secondary school education, plus the PSU mean of a dummy variable for the mother listening to the radio weekly, the PSU mean of a dummy variable for the mother watching television weekly, and a household wealth index. These variables are also interacted with dummy variables for the child's age category. The basic controls also include birth order dummy variables up to birth order four. The extended set of control variables includes a dummy variable for the mother getting any prenatal care during the pregnancy, home delivery, and the child having any vaccination, plus the interactions with dummy variables for the child's age category.

$^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$

suggest that the control variables included are adequately addressing the other factors that might be correlated with FP information and the outcome.

This second point is important because the instrumental variables strategy rests on the assumption that the instrument is not correlated with omitted factors and, in addition, affects breast-feeding only via the channel of contraceptive use. The extensive set of control variables reduces the likelihood that the FP information variable is picking up omitted factors. That the first-stage coefficients, as well as the instrumental variables (IV) coefficients presented later, are stable when additional control variables are added is reassuring.

As a further check on the exogeneity of the instrument, Table 4 runs a set of placebo tests that examine the effect of contraceptive use, instrumented with FP information, on predetermined outcomes or other health behaviors. The first outcome I examine is the husband-wife age gap, which is likely determined before the woman is receiving any FP information, and in any case, should not be affected by information campaigns about modern contraception. A correlation between the instrument and this predetermined outcome would indicate endogenous placement of FP information campaigns. Both with and without control variables, this outcome is not strongly correlated with the instrument; the "effect" of contraceptive use, instrumented with FP information, on the husband-wife age gap is statistically indistinguishable from zero.

In addition to the requirement that the instrument be exogenous, the exclusion restriction must hold: that is, FP information must not have other direct effects on breast-feeding. This problem could arise if the FP workers encouraged mothers to breast-feed. This concern motivates the inclusion of other health behaviors, such as prenatal care use, vaccinations, and home birth in the extended set of control variables.

Table 4 Placebo test: "Effect" of contraceptive use on other outcomes

	Husband–Wife Age Gap			Age at First Birth			Had Birth Attendant		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Contraceptive Use	0.334	1.251	1.480	2.428**	0.009	–0.129	0.726**	0.013	–0.058
	(0.625)	(0.956)	(1.079)	(0.625)	(0.805)	(0.891)	(0.096)	(0.092)	(0.098)
Observations	22,837	22,837	22,837	17,657	17,657	17,657	25,782	25,782	25,782
R^2	.00	.01	.00	.00	.15	.16	.00	.39	.44

Notes: Standard errors, clustered by PSU, are in parentheses. Contraceptive usage is instrumented with FP info, which is the PSU mean among sample women (excluding the respondent) of a dummy variable for receiving information from any of the three possible FP information sources: radio, television, and FP worker. All regressions include dummy variables for the child's age: ≤3 months, 4–6 months, 7–12 months, or 13–24 months. The basic set of control variables includes dummy variables for each combination of the survey wave and the island on which the PSU is located, rural, and the mother having at least secondary school education, plus the PSU mean of a dummy variable for the mother listening to the radio weekly, the PSU mean of a dummy variable for the mother watching television weekly, and a household wealth index. These variables are also interacted with dummy variables for the child's age category. The basic controls also include birth order dummy variables up to birth order four. The extended set of control variables includes a dummy variable for the mother getting any prenatal care during the pregnancy, home delivery, and the child having any vaccination, plus the interactions with dummy variables for the child's age category.

**$p < .01$

If the FP workers gave general maternal and child health advice, then in addition to encouraging breast-feeding, they likely would encourage prenatal care, vaccinations, and delivery in a health facility. As a further check, Table 4 examines whether the instrument is correlated with other fertility and health behaviors— specifically, age at first birth and whether a trained birth attendant was used. For age at first birth, I restrict the sample to women who had their first birth at least two years before the survey date so that FP information is measured well after their age at first birth was determined (although the results are similar without this restriction). Without any control variables, contraceptive use is associated with a higher age at first birth and greater use of a birth attendant. Although ideally there would be nothing systematic about where FP information is available, this pattern is not too surprising. The key test is whether the instrument is associated with these other outcomes, conditional on the control variables. Using the preferred specification with the basic control variables (columns 5 and 8) as well as in the specifications with the extended set of control variables (columns 6 and 9), contraceptive use has no significant association with these other fertility and health behaviors.

These placebo results suggest that the set of control variables is adequately addressing the concern that FP information is correlated with other factors that might affect breast-feeding. Although exposure to FP information could be, in part, measuring women's unobserved fertility preferences, these preferences would have to be very specific to contraceptive use and be unrelated to the husband-wife age gap or demand for using a trained birth attendant. Also worth noting is that the hypotheses are about an age gradient in the relationship between breast-feeding and contraception, so any omitted variable or other channel driving the results would need to exhibit an age gradient as well.

Effects of Contraceptive Use on Breast-feeding

I now turn to testing the main hypothesis, which is that the causal effect of contraceptive use on breast-feeding is negative at young ages and then becomes positive at older ages. Figure 1 examines this relationship graphically by comparing areas with a low versus high degree of FP information. This is the raw relationship, not controlling for other factors. Before roughly age 12 months, the breast-feeding rate is not consistently higher or lower when more FP information is available, although in the first three months, breast-feeding appears somewhat lower when FP information is available. After age 12 months, the breast-feeding rate is consistently higher in the subsample with more FP information. In other words, the raw data show no strong evidence of the substitution effect, except possibly in the first three months after childbirth, but seem to show evidence of the birth-spacing effect at older ages. The regression analysis will confirm these patterns that are visible in the raw data.

Table 5 examines the relationship between breast-feeding and contraception in a regression framework. FP information is used as an instrumental variable for contraceptive use. The first three columns show the average effect of contraceptive use on breast-feeding, which bundles the hypothesized negative substitution effect and positive birth-spacing effect. Column 1 is the relationship without the set of control variables. The coefficient on FP use is positive and marginally significant: FP use

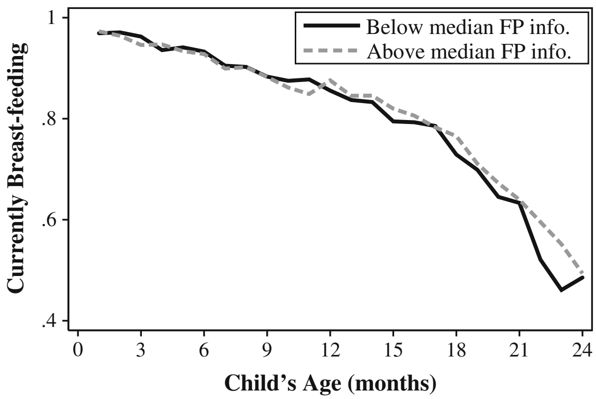

Fig. 1 Breast-feeding rate as a function of the child's age. The figure plots the average rate of breast-feeding by age, separately for the subsample with above-sample-median FP information (proportion of women in the PSU who received information from radio, television, or an FP worker) and the subsample with below-sample-median FP information

causes an increase in breast-feeding by 9 percentage points, on average. Column 2 includes the set of controls that should adjust for factors correlated with FP information; here, the average effect is 15 percentage points, which is significant at the 5 % level. Adding in the extended set of controls in column 3 leaves the coefficient essentially unchanged, which is reassuring.

The key hypotheses, though, are about how this average effect varies with the child's age. In column 4, without control variables, the point estimate is negative and insignificant for children under 3 months old (the omitted category). The point estimate suggests that contraceptive use reduces the likelihood of breast-feeding by 7.4 percentage points for children in this age range. For children age 4–6 months and 7–12 months, the interaction terms are positive, implying a more positive impact of FP use on breast-feeding at older ages, as predicted. The total effect of FP on breast-feeding at these ages is very close to zero; the main effect and interaction effects are similar in magnitude and opposite in sign. For children older than 12 months, the interaction coefficient is much larger in magnitude and statistically significant. Rows at the bottom of the table report the *p* value for the total effect by age group; the effect of FP information on breast-feeding is significantly positive at the 5 % level for age 13–24 months and older.

Column 5 presents the main specification of the article: it shows the effects of contraception on breast-feeding including the set of control variables (and the control variables interacted with age dummy variables). First, the main effect of FP information indicates no statistically significant effect of FP information on breast-feeding for very young children, although the coefficient of –0.055 suggests that contraceptive use might reduce breast-feeding in this age range. This lack of statistically significant evidence of a substitution effect is in contrast to findings from previous research in, for example, the Philippines (Rous 2001). One possible explanation is that the Indonesian government's efforts to promote child health made mothers value breast-feeding as a way to make their children healthy. If this were the case, few mothers would opt out of breast-feeding even when the availability of contraceptives made the fertility-suppressing property of breast-feeding less important to them. Indeed, the rate

Table 5 Effect of contraceptive use on breast-feeding

	Currently Breast-feeding					
	(1)	(2)	(3)	(4)	(5)	(6)
Contraceptive Use	0.091†	0.152*	0.158*	–0.074	–0.055	–0.053
	(0.049)	(0.072)	(0.079)	(0.075)	(0.111)	(0.134)
Contraceptive Use × Age 4–6 Months				0.060	0.094	0.105
				(0.099)	(0.159)	(0.187)
Contraceptive Use × Age 7–12 Months				0.080	0.110	0.093
				(0.114)	(0.158)	(0.182)
Contraceptive Use × Age 13–24 Months				0.269*	0.314*	0.321†
				(0.107)	(0.154)	(0.178)
Observations	25,785	25,785	25,785	25,785	25,785	25,785
R^2	.07	.11	.12	.07	.12	.12
Effect for 4–6 Months = 0 (p value)				.83	.73	.69
Effect for 7–12 Months = 0 (p value)				.95	0.64	.75
Effect for 13–24 Months = 0 (p value)				.01	.02	.03
Controls, Basic	No	Yes	Yes	No	Yes	Yes
Controls, Extended	No	No	Yes	No	No	Yes

Notes: Standard errors, clustered by PSU, are in parentheses. Contraceptive usage is instrumented with FP info, which is the PSU mean among sample women (excluding the respondent) of a dummy variable for receiving information from any of the three possible FP information sources: radio, television, and FP worker. All regressions include dummy variables for the child's age: ≤3 months, 4–6 months, 7–12 months, or 13–24 months. The basic set of control variables includes dummy variables for each combination of the survey wave and the island on which the PSU is located, rural, and the mother having at least secondary school education, plus the PSU mean of a dummy variable for the mother listening to the radio weekly, the PSU mean of a dummy variable for the mother watching television weekly, and a household wealth index. These variables are also interacted with dummy variables for the child's age category. The basic controls also include birth order dummy variables up to birth order four. The extended set of control variables includes a dummy variable for the mother getting any prenatal care during the pregnancy, home delivery, and the child having any vaccination, plus the interactions with dummy variables for the child's age category.

†$p < .10$; *$p < .05$

of breast-feeding is considerably higher in the Indonesian context I study than in the Cebu sample studied in the Philippines.[10] The high breast-feeding rate at young ages also reduces the statistical power to measure the substitution effect precisely.

The second pattern seen in column 5 is that for older children, as predicted, there are positive effects of FP use on the likelihood of being breast-fed. The net effect of FP use on breast-feeding is statistically significantly positive for children age 1 year and older. For children in this age range, contraceptive use increases the rate of breast-feeding by 26 percentage points (0.314 – 0.055), and this effect is statistically significantly different from zero, with a p value of .02. Column 6 reports the results with the extended controls and their interactions with the age dummy variables. The results

[10] For example, the breast-feeding rate among children age 6 months is 93 % in the Indonesian sample compared with 76 % in Cebu. At age 12 months, the rate is 86 % in Indonesia and 64 % in Cebu; at age 24 months, the rate is 46 % in Indonesia and 14 % in Cebu (Zohoori et al. 1993).

are very consistent with the earlier specifications: contraception leads to a significant increase in breast-feeding of toddlers.

These main results are robust to various changes in the specifications. First, Table S2 in Online Resource 1 uses an alternative instrument calculated from women surveyed in the DHS who do not have a child age 24 months or younger and are thus not in the analysis sample. As before, the assumption is that women in the same PSU have a similar amount of FP information available to them, although that information may vary somewhat by demographic group if, for example, FP workers target women with young children. Information on FP among nonsample women is indeed predictive of contraceptive use among sample women, but it has less predictive power than FP information among women with young children (i.e., the first stage is not as strong). Therefore, the standard errors for the IV estimates of the effect of contraceptive use on breast-feeding are considerably larger than those seen in Table 5, but the coefficients are very similar. The point estimates in Table S2 point to a small negative substitution effect for young ages and then a sizable positive birth-spacing effect for older children.

Table S3 in Online Resource 1 shows that the results are also robust to defining FP information as the PSU mean of the sum of separate dummy variables for receiving FP information from radio, television, and an FP worker, rather than a dummy variable for any exposure. Again, the net effect of contraceptive use on breast-feeding becomes statistically significantly positive at age 13 months, as seen in the main results—although in this case, the differential effect relative to the youngest age group is marginally significant for age 7–12 months.[11] In further robustness checks not reported here, I also show that the results are not driven by selective mortality of children.[12]

To summarize, as predicted, the effect of contraceptive availability on breast-feeding exhibits a gradient in the child's age. The results offer suggestive but statistically weak support for Prediction 1; there seems to be a substitution effect in Indonesia for children age 3 months and younger. I find strong evidence of Prediction 2, regarding the birth-spacing effect. Contraceptive use increases the propensity to breast-feed children age 1 year and older. This effect is consistent with contraception delaying or preventing subsequent pregnancies that otherwise might trigger the mother to stop nursing her child.

Effects of Family Planning Information on Subsequent Fertility

To validate the results, I next show that the mother's subsequent childbearing mirrors the patterns seen for breast-feeding. The hypothesized reason why FP use increases the likelihood that toddlers are breast-fed is that FP use prevents or delays subsequent

[11] The coefficient for ages 4–6 months and 7–12 months are larger in magnitude with the alternative IV, and the implied effect sizes are large given that the rate of breast-feeding is high for these age groups. The first stage is not as strong with the alternative IV, which suggests that the sum of exposure to FP information from the different channels may not be the correct functional form because, for example, there are diminishing returns to receiving FP information through multiple channels.

[12] I reestimate the results, including the 1,021 deceased children who would have been under age 24 months at the time of the survey, making extreme assumptions about their breast-feeding status had they lived in order to bound the coefficients. If they had been weaned by the time of death (which is recorded in the survey), I treat them as not currently breast-feeding. If they had not been weaned, I first assume that 100 % of them would have been nursing at the time of the survey and reestimate the models. Second, I reestimate the models assuming that none of them would have been nursing. In both cases, the coefficients are similar to the main estimates.

Table 6 Effect of contraceptive use on subsequent fertility

	Pregnant or Has a Younger Child					
	(1)	(2)	(3)	(4)	(5)	(6)
Contraceptive Use	–0.017	–0.072*	–0.074*	–0.000	0.005	0.007
	(0.022)	(0.031)	(0.035)	(0.000)	(0.008)	(0.010)
Contraceptive Use × Age 4–6 Months				–0.008	–0.006	–0.006
				(0.007)	(0.012)	(0.014)
Contraceptive Use × Age 7–12 Months				0.026	–0.022	–0.023
				(0.032)	(0.040)	(0.044)
Contraceptive Use × Age 13–24 Months				–0.042	–0.134*	–0.139*
				(0.041)	(0.055)	(0.060)
Observations	25,785	25,785	25,785	25,785	25,785	25,785
R^2	.05	.10	.10	.06	.13	.13
Effect for 4–6 Months = 0 (p value)				.24	.86	.89
Effect for 7–12 Months = 0 (p value)				.41	.67	.71
Effect for 13–24 Months = 0 (p value)				.30	.02	.03
Controls, Basic	No	Yes	Yes	No	Yes	Yes
Controls, Extended	No	No	Yes	No	No	Yes

Notes: Standard errors, clustered by PSU, are in parentheses. Contraceptive usage is instrumented with FP info, which is the PSU mean among sample women (excluding the respondent) of a dummy variable for receiving information from any of the three possible FP information sources: radio, television, and FP worker. All regressions include dummy variables for the child's age: ≤3 months, 4–6 months, 7–12 months, or 13–24 months. The basic set of control variables includes dummy variables for each combination of the survey wave and the island on which the PSU is located, rural, and the mother having at least secondary school education, plus the PSU mean of a dummy variable for the mother listening to the radio weekly, the PSU mean of a dummy variable for the mother watching television weekly, and a household wealth index. These variables are also interacted with dummy variables for the child's age category. The basic controls also include birth order dummy variables up to birth order four. The extended set of control variables includes a dummy variable for the mother getting any prenatal care during the pregnancy, home delivery, and the child having any vaccination, plus the interactions with dummy variables for the child's age category.

*$p < .05$

pregnancies. Table 6 is similar to Table 5 except the outcome is a dummy variable for the mother either being pregnant or having given birth to another child. Focusing on the preferred specification, reported in column 5, one can see that FP use has a negative effect on subsequent fertility beginning four months after the previous birth, and this negative effect becomes statistically significant one year after the previous birth. In other words, FP information reduces the fertility of postpartum women for the same age ranges that show a positive effect of FP information on breast-feeding.[13]

[13] Although statistically indistinguishable from each other, the effect size for subsequent fertility is smaller than the effect size for breast-feeding. One possible explanation is that many mothers are not aware they are pregnant early on, and thus might report in the DHS that they are not pregnant. Meanwhile, the fact that they are actually pregnant might nonetheless precipitate weaning. For example, the mother might produce less milk because calories are being diverted to the fetus (Feldman 2000).

Conclusion

Previous research on contraception and breast-feeding has emphasized a crowd-out effect: FP programs might have the negative unintended consequence of causing mothers to substitute away from breast-feeding after they have access to contraceptives. This article highlights a different link through which FP programs can increase breast-feeding. By allowing mothers to space births farther apart, contraception makes it possible for a mother to breast-feed her child for longer. Underlying this birth-spacing channel is the fact that a subsequent pregnancy or childbirth is often what triggers weaning.

The different timing of the substitution effect (which is strongest right after birth) and the birth-spacing effect (which is strongest further after birth) allows one to unpack the two effects. Using variation in access to contraceptives induced by government efforts to raise awareness about family planning, I show that in Indonesia, contraceptive use indeed increases the likelihood that children are breast-fed past the age of 1 year. The point estimates suggest that a small substitution effect is present for children age 3 months and younger, but this result is not statistically significant. The fairly weak evidence of the substitution effect may be because of mothers' strong commitment to breast-feeding in Indonesia compared with previously studied contexts; mothers in Indonesia might want to breast-feed even when they no longer need to do so to prevent pregnancy. Combining these results, access to contraceptives has a net positive unintended consequence of increasing the average duration of breast-feeding in this setting.

The benefits of breast-feeding are not uniform for children of different ages, however. The health benefits are widely regarded to be strongest at young ages, so one case of a child being weaned at a young age because of the substitution effect might not be offset by one case of a child being breast-fed up to age 2 years because of the birth-spacing effect. The net health effects also depend on which subpopulations are affected through each of these two channels. If the health benefits of breast-feeding are especially large for the group susceptible to substitution effects (e.g., because weaning foods happen to be particularly unhealthy for those who are most susceptible to the substitution effect), the negative effects on child health would be more likely to dominate, and vice versa. Health benefits are not the only reason for breast-feeding, however. Although a mother's desire to breast-feed her child past age 1 simply as a way to bond with her child may be a difficult benefit to quantify, it may be an equally important benefit of prolonged breast-feeding.

Something that the substitution and birth-spacing effects have in common is that both suggest that FP access and breast-feeding promotion are complementary policies. In the case of the substitution effect, pairing FP efforts with breast-feeding promotion reduces the likelihood that the former policy unintentionally reduces the rate of breast-feeding. In the case of the birth-spacing effect, a breast-feeding promotion program may be effective at raising mothers' desire to breast-feed, but mothers may find it difficult to do so for as long as they wish if they unintentionally become pregnant again. If the breast-feeding promotion campaign is paired with greater access to contraceptives, mothers' increased desire to breast-feed is more likely to translate into an actual increase in the duration of breast-feeding.

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