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Family Size in Colombia: Guessing or Planning? Intended vs. Actual Family Size in Colombia*

¿Se planea el tamaño de la familia en Colombia? Fecundidad deseada frente a fecundidad efectiva en las familias colombianas

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Abstract

In this paper, we attempt to analyze the determinants of unintended births among Colombian women aged 40 years old or more using data from the *Encuesta Nacional de Demografía y Salud 2005*, which is Colombia´s national demographic and health survey. Given the especial characteristics of the variable under analysis, we used count data models in order to test whether certain characteristics of women and their socioeconomic backgrounds such as their level and years of schooling or socioeconomic group, explain the number of unintended births. We found that women's education and the area of residence are significant determinants of unintended births. The inverse relationship

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between the level of education of women and the number of unintended births has key implications to social policies.

Key words: family size, unintended births, schooling, count data models.

JEL classification: C4, I21, J13.

Resumen

En el artículo se analizan los determinantes de la presencia de hijos no planeados en Colombia. Se utiliza la información de la Encuesta Nacional de Demografía y Salud 2005, específicamente para las mujeres de cuarenta años o más. Dadas las características especiales de la variable que se analiza, se utilizan modelos de conteo para verificar si determinadas características socioeconómicas, como la educación o el estrato económico, explican la presencia de hijos no deseados. Se encuentra que la educación de la mujer y el área de residencia son determinantes significativos de los nacimientos no planeados. Además, la relación inversa entre el número de hijos no deseados y la educación de la mujer tiene implicaciones cruciales en cuanto al manejo de la política social.

Palabras clave: tamaño de la familia, nacimientos no planeados, educación, modelos de conteo.

Clasificación JEL: C4, I21, J13.

Introduction

For several decades, most research studies have focused on the determinants of the demand for children in households, measured empirically by analyzing the responses to questions on desired family size. The limitations of this approach are well known, and they are as follows: the timing of the answer and changes in preferences over time. In the last twenty years, the interest on the ideal family size has grown as shown in several studies (Freedman, Coombs and Chang

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(1972), Dow and Werner (1981), Carpenter-Yaman (1982), Girard and Roussel (1982), Gomes (1984), Isiugo-Abanihe (1994), Stash (1996), Hagewen and Morgan (2005)). At the same time, there has been an emerging concern about unintended pregnancy and its determinants in less developed countries (Bongaarts (1997) Islam and Rashid (2004), Le, Magnani, Rice, Speizer and Bertrand (2004) and, Becker and Sutradhart (2007)). Some of these efforts are based on seminal works of Becker (1960, 1981) and Liebenstein (1957, 1974). However, to the best of our knowledge, the relation between the preferred number and the actual number of children has not received similar attention in less developed countries, where a considerable proportion of the population still live in rural areas and do not have access to many contraceptive programs. These facts and the persistence of income inequality in poor countries justify the need to disseminate information and knowledge on this phenomenon.

The purpose of this paper is to analyze the determinants of unintended births among Colombian women aged 40 years old or more, in 2005. Not only in less developed but also in developed countries, it is common to find that the actual family size is bigger than the desired size. There are many factors explaining this difference and we want to explore one of them here. We want to assess the effect of schooling on the gap between the desired and final number of children, particularly in family units where there are more children than initially planned. We excluded those cases where there were actually fewer children than desired. The rationale for excluding them is that most of these cases could be a consequence of biological or economic constraints on one side and divorces or widowhood on the other side. Here, we assume that unintended children exist, when the actual is bigger than the desired or expected number of children.

The main contributions of our study are threefold. First, there is no recent study on this variable in a Latin American country such as Colombia, where there is a well known public health program in contraception led by Profamilia. Second, although fertility has declined around the world, this reduction has been different in developed and developing countries and between people at the top and at the bottom of the income pyramid. Third, the empirical approach is novel because we used count data models that allowed us to take into account the

discreteness condition of the number of children and to reduce the bias in the analysis compared to bi-variate analyses and traditional ordinary least squares (for details on this methodology see Winkelman, 2008 and Cameron and Trivedi, 2005).

The paper is organized as follows. Section I summarizes some of the recent literature on the demand for children, unintended births and intended family size. Section II presents the data, methodology and results. In the last section, we have our comments and policy recommendations.

I. Literature review

The study of the differences between desired and realized fertility has received few attention in developing countries. Most of the works are focused on family size and its determinants. However, one of its most relevant limitations is the possible existence of changes in fertility preferences over time. In general, demographers distinguish between preferred or desired family size and fertility ideals.

On the one hand, Thomson (2001, p. 5347) refers to *desired family size* as 'the number of children wanted in one's lifetime', and can be viewed as the demand for children. McClelland (1983, p. 288) defines desired family size as 'the number of children parents would have if there were no subjective or economic problems involved in regulating fertility'. Some authors such as Lee and Bulatao (1983) classify the factors that influence the family-size desires in aspects such as: income and wealth, tastes and preferences, the cost-benefit analysis of children, and the opportunity cost of childbearing and childrearing. Although important reductions in total fertility have taken place around the world and some authors find that in many countries total fertility is below the replacement levels (Schultz (1998); Bryant and Zick (2005) among others), there are countries where a considerable proportion of *unintended children* still exists.

As can be seen, it is a rational choice in which people try not to guess but to plan. Certainly, we could think that in general, parents try to *control* the number of children they want to have. Some of the links

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between that control and their success are due to the effect of schooling on fertility. The negative effect of schooling on fertility has been widely studied in different literatures (Cochrane (1979); Ainsworth, Beegle and Nyamete, (1996); Schultz (1998)). Some evidence for Colombia has been provided recently. (Forero and Gamboa (2008)). Families with a lower schooling level tend to have less knowledge of contraception methods and this leads to bigger families in low-income and less educated groups than in higher ones. Therefore, we expect the level of education to be negatively related to the number of unintended or *guessing* of children.

On the other hand, *fertility ideals* refer to what is desirable for population in general, without specifying the wishes of any particular person. (Thomson (2001) and Hagewen and Morgan (2005)). In this approach, the concept of family size is less important.

From a microeconomic approach, the definition of unintended children as the difference between the desired number of children and the actual births that the woman has implies a special analysis. The presence of unintended births may be correlated to socioeconomic status or education variables. Therefore, this work can shed some light on the respective policy issues.

We may find two groups of factors that determine the presence of unintended children. On one side, the factors that affect the desired family size include preferences, religion, socioeconomic status among others and on the other side, factors that determine the total (final) number of children include biological aspects, marital status, use of contraception methods and cultural aspects. As we mentioned above, the demand for children includes several dimensions and the interaction of those different factors. However, it is also the couples' joint choice in most of the cases.

In a supply-demand framework, we can think of unintended children as "failures" in the demand for children. These types of failures can take place because of two reasons: first, couples do not have information or access to contraception methods; second, changes in preferences. If a woman is asked how many children she wants to have, her answer could be different if she does not have any kids at the

moment of questioning, or if she has had one or more children. Thus, preferences can change during the lifecycle, influenced by economic constraints; namely, when women realize that bringing up children is 'expensive', then she decides not to have as many kids as she had thought or planned.

There is an extensive literature on desired family size which gives us some ideas for understanding of the existence of unintended children (Leibenstein (1957); Becker (1960, 1981); Becker and Lewis (1973); Schultz (1973) Haskell (1977); Unger and Molina (1999) and Kiriti and Tisdell (2005), among others).

Becker (1960) and Becker and Lewis (1973) affirm that since people from low socioeconomic backgrounds do not have wide knowledge of birth control mechanisms, they tend to have more unintended children. Nevertheless, setting aside access to contraceptives, they show that couples make a cost-benefit analysis when planning family size. The question is *what are the main variables that families take into account when they make that analysis?* In less developed countries the probability of either receiving an additional income or having an additional free worker is probably higher than the cost of childbearing. Schultz (1973, p. S3) argues that parents take into account the expected benefits they can get from children and 'equate the marginal sacrifices and satisfactions'. Nevertheless, there is no consensus about thinking of children as consumption goods.

In a similar way, Leibenstein (1957) claims that families make a cost-benefit analysis of having another child, in order to make the decision of having children or not, in the case when they already have one or two children (he focuses on births of higher order). He calls it a *balance* between utilities and disutilities of having an extra child. In the first group he includes the utility derived from *consumption* which means that new sons or daughters are desired for themselves. In the second group he mentions the disutilities associated to the costs —including the opportunity costs— of bringing children up.

From the empirical point of view, Haskell (1977) analyzes the determinants of fertility desires in 220 undergraduates of the University of Tennessee. His results indicate that religiousness is one of the most

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important factors explaining preferred number of children. In the case of women, factors such as being younger also affect fertility preferences. For men, having been born in a large family influences the desire of having a large family too. These results are intuitive, since we could think that religion may influence preferences of family size through constraints on birth control mechanisms. In Latin American countries, where most people are Catholic, cultural and religious motivations affect choices such as marriage, demand for children, and contraception methods.

Along the same lines, family size could be affected by the gender of the first child. Some aspects such as male labor participation and the desire to have continuity of the family name explain larger families in some cases. Unger and Molina (1997) study son preferences among a sample of 432 Hispanic women of low socioeconomic status and they find that these women tend to prefer sons instead of daughters (maybe because of cultural aspects). This may explain why they do not use contraceptives until they have had a son. According to them, women who are 30 or more years old, less educated, divorced or widowed, or women who have been brought up in large families, tend to desire more sons. They argue that, there is evidence confirming that son preference is prevalent among Hispanic women in the United States. Similar results are found in Kiriti and Tisdell (2005) who find that the strong son preference in Kenya is due to husband expecting to have male children in order to ensure the survival the family name. Consequently, a possible explanation of large families among these populations is that, couples keep on childbearing until they have a son. This negative relationship between education and the number of children (and especially, more sons) is also found in small samples in McCarthy and Gbolahan (1987) and Unger and Molina (1999). Although their samples may not be representative, we could expect similar results for the Colombian case. Williams and Pratt (1999) argue that 35% of the births from 1983 to 1988 in the United States were unwanted. They identify that black women are more vulnerable to this situation as a consequence of factors such as earlier initiation of sexual activity and lower attendance at family planning clinics.

In these studies, women's and her partner's education, gender composition and the presence of male-dominated cultures may influence

the desired fertility (and hence, the presence of unintended children). Accordingly, if less educated women believe that one of the reasons to have sons is to preserve the family name, these women may: (i) tend to have more unintended children (girls), while they keep trying for a son; (ii) have more children due to the fact that they are less educated and hence, have a lower opportunity cost of bringing them up, for instance.

As it can be seen, the existence of a positive gap between realized and desired fertility could be derived from multiple factors (internal and external) to women preferences. Thus, we have two different hypotheses. **H-1:** Observed fertility is higher than desired fertility as a consequence of failures in family formation due to factors such as barriers to access to contraception methods or gender preference. **H-2**: The gap between observed and desired fertility is due to time changes in preferences that could induce women to regret their initial preference.

II. Data, methodology and results

A. Data and methodology

We use the Demographic and Health Survey (*Encuesta de Demografía y Salud*, DHS) carried out by *Profamilia* during 2005 with technical assistance from Macro International (Maryland, USA). The DHS survey is done in Colombia every five years since 1990, but each one includes specific questions that are not always comparable. However, DHS is representative of the country situation and among other variables that this survey takes into account are information about health status, contraception methods, sexual behavior, fertility, food habits, and socioeconomic status. Its design includes different segments for specific themes. For instance, questions on body mass index were asked to 117.000 people and fertility questions were posed to 49.000 women. In total, the sample size of the survey is about 120.000 persons from more than 37.000 households located around the entire country. In this study, we extracted a subset of questions for characterizing adult women and it reduced the sample for the empirical analysis.

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For statistical purposes, we only included non-pregnant women who are older than 40 years since they seem to have completed their fertility choices already[1]. We also excluded observations of women who do not give numerical responses to questions about fertility and those observations without socioeconomic information (socioeconomic strata or education). We check in this last case to guarantee that there is no bias in the final sample with respect to the entire database. After these procedures, our final sample is about 5.567 observations (women) distributed as follows: 79% from rural areas, 49% with basic education or less and 11% with higher education, and 7% from Bogotá, the capital city.

Our dependent variable is the gap between realized fertility (the final number of children) and desired fertility (the reported preferred number of children of the woman). DHS asks the women who were interviewed about their family size preferences (instead of asking about *ideal*)[2]. The specific question is '*If you could go back to the time when you still did not have any children and if you could choose the exact number of children to have in your lifetime, how many would you have?*' In the case of women with no living children, the question is '*If you could choose the exact number of children to have in your lifetime, how many would you have*?

From this question, we construct the gap between realized fertility and desired fertility, Y_i. Clearly, Y_i can be zero, positive or negative. In cases in which Y_i is positive, i.e., realized fertility is higher than desired fertility, we define Y_i as the number of unintended children. An initial research question would be to assess whether positive and negative values of Y_i are determined by the same set of factors.

The existence of positive or negative values in Y_i, could be a consequence of changes in preferences over time and external shocks such as income reductions, health problems, divorces, widowhood, unemployment, or domestic violence among other aspects. In order to test whether the determinants of positive and negative values of Y_i are the

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[1] We estimate that the percentage of women older than 40 who have an additional child is less than 2% of the sample.

[2] As we mentioned before, there is a difference between desired family size and fertility ideals. In this sense, DHS asks about the former.

same, we estimate a multinomial logit model in which the dependent variable is the complete support of Y_i. Our findings indicate that the determinants of positive Y_i, and negative Y_i, are different[3]. Thus, in the empirical analysis that follows we focus exclusively on unintended number of children, i.e., $Y_i > 0$. The study of the determinants of $Y_i < 0$ is, in our opinion, less interesting from the economic point of view as it could be mainly determined by changes in health and economic status of the household.

After this censoring process, the domain of the variable unintended children (Y_i) is non-negative which allows us to use count data models. Among the most known count data models, we have two types of models based on the distribution of the variable and their variance[4].

On the one hand, there are Poisson Regression Models (PRM) and Negative Binomial Regression Models (NBRM). PRM is a method intended for cases where the variable of interest follows a Poisson distribution function and one of its most important features is that the mean tends to be equal to its variance (equi-dispersion). As it rarely occurs empirically, the other distribution known as NBRM can be obtained from a mixture of a Poisson and a Gamma distribution functions and it relaxes the equi-dispersion assumption.

On the other hand, we have a particular case of truncated models which are the Zero Inflated Poisson (ZIP) and Zero Inflated Negative Binomial (ZINB) models. ZIP and ZINB are mainly used when the incidence of zeros in the dependent variable is high and its use depends on the distribution behind the data. In our case, the higher prevalence of zeros is understood as success, because in these cases, desired fertility is equal to realized one (see Table 1). However, in order to test the robustness of the results, we estimated using all the models mentioned. In their simplest form, given a *y* count-valued random variable, zero inflated models are specified as having a probability function

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[3] In order to test this, we estimate a multinomial logit model, where the dependent variable is: $y_i < 0$, $y_i = 0$ and $y_i > 0$. Our findings indicate that there is no evidence that suggests that the determinants of the three possible outcomes of Y_i are the same. These results are not reported but are available upon request.

[4] These models are employed when an important proportion of the data has *zeros*, when the mean is low, and when the data are non-negative integers.

$$f(y)=\begin{cases}\pi+(1-\pi)f^{*}(0) & for\ y=0\\ (1-\pi)f^{*}(y) & if\ y=1,2,3,...\end{cases}$$

where $\pi\in[0,1]$ is a zero-inflation parameter which allows for any fraction of zeros. The function $f(.)$ is a standard count probability function. The two most common choices for $f(.)$ are Poisson (f^{P}) and Negative Binomial f^{NB} with the following expressions:

$$f^{P}(y;\lambda)=\frac{\exp(-\lambda)\lambda^{y}}{y!},\lambda>0$$

and

$$f^{NB}(y;\lambda)=\frac{\Gamma(\gamma+y)}{\Gamma(\gamma)\Gamma(y+1)}\left(\frac{\gamma}{\lambda+\gamma}\right)^{\gamma}\left(\frac{\lambda}{\lambda+\gamma}\right)^{y},\lambda>0,\ \gamma>0$$

These functional forms can be used for regression analysis. As it can be found in the literature, in an econometric regression, it is common to specify the mean parameter λ as a function of a vector of explanatory variables x which could be estimated by maximum likelihood (See also Staub and Winkelmann (2009), for details).

Table 1. Unintended children by area of residence, Colombia 2005.

Number of unexpected births	Rural areas	Urban areas	Total
0	34,35	50,25	47,1
1	14,08	17,47	16,8
2	16,7	16,82	16,8
3	11,53	8,1	8,79
4	9,66	3,92	5,08
5 or more	13,68	3,44	5,49
Total	100	100	100

Source: DHS – Macro International, 2005.

It is important to emphasize that in contrast to ordinary least squares, count data estimates cannot be interpreted in a straightforward way. They contain all the relevant information and we can easily use them to determine *semi-elasticities* (See, for details, Cameron and Trivedi (2005) or Winkelman (2008)).

However, due to the unavailability of panel data, we have to compare events from two different points: at the beginning of fertile age and at the end of it, which prevents us from validating hypothesis **H-1** vs **H-2** mentioned above. Given that these hypotheses seem to be the main factors explaining the presence of unintended children (besides the variables considered in the models), we test for the existence of changes in desired fertility over the woman's lifecycle by using two different strategies.

First, we run a regression of the desired number of children (desired fertility) on a set of explanatory variables using a subsample that only includes women between 18 and 25 years old. The regressors include age, years of schooling, urban zone, marital status, socioeconomic strata, and knowledge of a contraceptive method. The resulting estimated coefficients are subsequently used to produce out-of-sample forecasts of desired fertility at the beginning of fertile age for all the women in the sample (labeled "estimated" desired fertility)[5].

We compare this variable with another variable extracted from the survey which is the actual answer to the question about desired fertility, which we label "*Observed*" fertility.

Both "estimated" and "observed" fertility variables are shown in table 2, for grouped ages. The average difference between observed and estimated desired fertility is very small. By age range, all these differences are positive. It means that predicted desired fertility at the beginning of fertile age is slightly lower than reported desired fertility at each range later in the life-cycle. In other words, the results indicate that the reported number of desired children does not change significantly as women age. Consequently, these results are evidence against the second hypothesis because there are no signs of regret in the number of desired children over the life-cycle. If fertility preferences remain constant over the women's life cycle, the main reason for unintended births should be due to **H2**, i.e., other failures in family formation.

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[5] In order to test the robustness of the results, the regression model was also estimated using women in the following ranges of age: 18-23 years; 18-24, years and 18-26 years. The results are qualitatively the same and therefore not reported here.

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For the second strategy, we use a non parametric approach for establishing the relationship between desired fertility and age. When we plot the estimated desired fertility based on the coefficients from young women and desired fertility reported in the DHS survey (in the vertical axis) with respect to age (in horizontal axis), we find the former is slightly different[6] (Figure 1). This means that desired family size seems to be increasing over the life-cycle rather than the opposite, which lends support to H-1. Again, this finding provides us with evidence against the second hypothesis, therefore favoring the first one.

Table 2. Differences between observed desired number of children and estimated desired fertility at beginning of fertile age.

		Desired fertility (observed)		Desired fertility (estimated)		
Age	**Obs.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Diff.**
15-19	620	1,98	0,76	1,98	0,11	0,001
20-24	2.941	2,03	0,80	2,03	0,11	0,000
25-29	3.747	2,14	0,93	2,10	0,11	0,038
30-34	3.985	2,33	1,10	2,17	0,11	0,155
35-39	4.146	2,51	1,28	2,25	0,12	0,254
40-44	3.844	2,69	1,44	2,33	0,12	0,368
45-50	3.501	2,86	1,57	2,41	0,12	0,459

Source: DHS – Macro International, 2005.

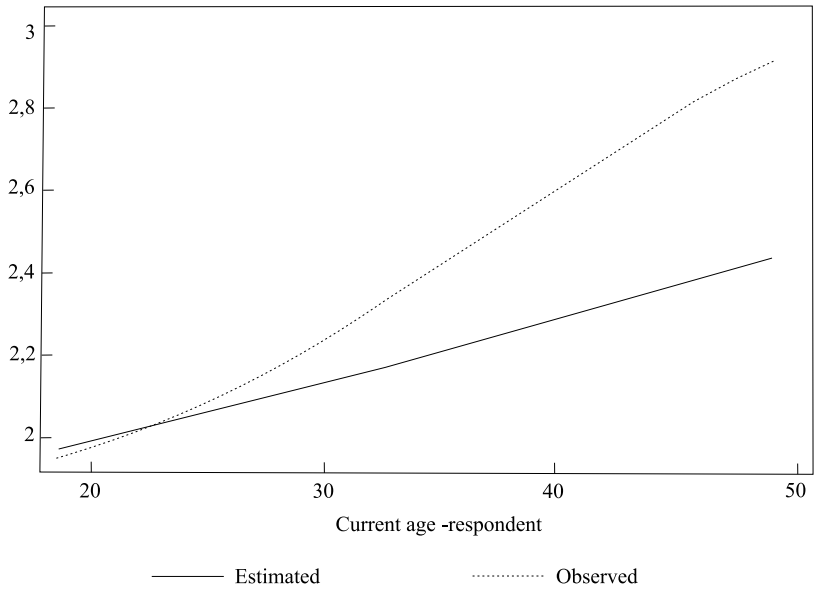
To summarize, what our results tend to support is that realized fertility is higher than desired fertility due to failures in family formation, e.g., access to contraception. It seems that there are no "regret effects" or changes in preferences over time.

After these procedures that allow us to get new evidence for isolating the two distinct hypotheses, we proceed to estimate the model in four specifications using different proxies for the women's socioeconomic background such as socioeconomic strata classification used by the government to define the level of subsidies for public utilities and an asset index constructed by the authors. Socioeconomic strata is a good categorical variable to proxy for income because it reflects the physi-

[6] These estimations are not shown but are available upon request.

cal conditions of the neighborhood in which the house is located (the existence of parks, main avenues, industries among others) and the conditions of the house (wall and floor materials, the availability of public utilities such as energy, water, and fixed phone in the house). This variable ranges from one (worst) to six (best) in the case of residential units and it is also a proxy for the price of housing. There are some houses without this classification and they are known as "illegal houses" because they were built without construction permits. In that case, policy makers place them at the bottom of the income pyramid. The variable 'socioeconomic strata' is one of the most common categorical variables used for classifying households in Colombia due to its correlation with income and wealth. Our proxy to *assets* is an index based on the possession of different assets in the household. The reason why we include such a variable is that it has been documented that physical assets —especially in agricultural societies— are related to higher fertility. See, for example, Schultz 1998.

Figure 1. Estimated and desired fertility by age.



Source: DHS – Macro International, 2005.

Among the explanatory variables we also include some control variables (age, age squared, a dummy that indicates if the woman lives in

rural areas, age at the birth of her first child, marital duration in years, and a dummy 'marital status' equal to one if she has a permanent or stable relationship (marriage or similar). External effects are proxied by two different variables. On the one hand, we include one dummy variable 'shock' equal to one if the women have faced situations that affect their long run expectations such as divorce or widowhood. We expect that the occurrence of such shock could reduce their desired number of children from the initial level and change their preferences. Statistical significance in shock implies positive evidence in favor of the hypothesis 2. On the other hand, we include the average number of total children in the strata and city where the women live. In this last case, our variable can get us some information about external pressures to have an additional child or the external control of the ignorance of future implications of additional children (see appendix 1).

From the health point of view, we test two variables, self related health status and Body Mass Index. Statistical significance in these variables can give us information about the importance of their physical health on the difference between desired and realized number of children.

The knowledge of contraception methods is also included with two different dummy variables: the use of contraception and knowledge about them. However, our database has one shortcoming: the information about use of contraceptives is only available at the time the survey is conducted, which limits its influence on the dependent variable. In order to get an idea about its influence on the dependent variable, we include a dummy variable that is equal to one if she has used a contraceptive method.

Two important aspects require attention. Although several works in the literature include references to religion, we do not have this information because the Colombian DHS does not include questions on this matter. However, given that majority of Colombians (more than the 85% of the population) are Catholic, omitting this variable will not have significant implications of omitted variables. Second, we do not have a panel data that allows us to evaluate changes in preferences for the same observation (women) in different times.

B. Descriptive statistics

The analysis of the distribution of our variable y_i, gives us some interesting results. By area of residence, we find that women living in cities have a higher rate of success of not having unintended children (36 out of 100 women in rural areas and 51 out of 100 in urban areas do not have unintended children) (Table 3). However, what is more important is that more than 10% of women in rural areas have five or more unintended children, (less than 3% in urban zones). In fact, a mean comparison test indicates statistically significant differences in the unconditional mean of unintended children by area of residence.

Table 3. Mean of unintended children and population distribution, Colombia 2005.

	Mean of unintended births	% Population
Age group		
40-44	1,2	50,8
45-49	1,4	49,2
Region		
Atlantica	1,32	18,34
Oriental	1,49	18,39
Central	1,28	26,76
Pacifica	1,37	16
Bogota	1,02	19,46
National territories	1,48	1,05
Socioeconomic strata		
No electricity	2,17	3,39
1	1,84	18,38
2	1,35	43,34
3	0,85	28,2
4	0,63	3,97
5	0,63	0,79
6	0,44	0,87
Educative level		
No education	2,53	5,35
Primary	1,72	41,56
Secundary	0,92	41,15
Higher	0,51	11,95
Mate's educative level		
No education	2,03	7,01
Primary	1,68	41,98
Secundary	0,99	37,04
Higher	0,56	13,96
Total	1,29	100

Source: DHS – Macro International, 2005.

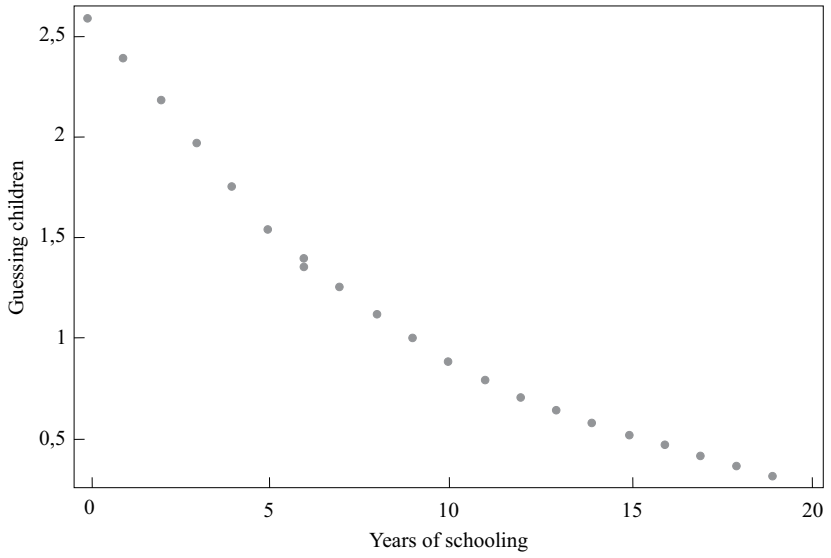
We also find incidence of unintended children more often among adult women (Table 3). For a deeper understanding of the relationship between the age and the number of unplanned children, we have to take into account changes in preferences or in socioeconomic backgrounds (education, income, marital status, among others). For instance, if we had information from the same woman in different time periods, by asking her the same question, *If you could go back to the time you still did not have any children and if you could choose the exact number of children to have in your lifetime, how many would you have*, the response would suggest if the woman has some regrets on her number of children If we can state that in fact she regrets it, we could affirm that a change in her preferences has taken place. Differences between the number of unintended children by age ranges, could also be a consequence of changes in socioeconomic situation faced or expected by the woman or her partner. In our database we only have information in one point and it prevents us from directly evaluating changes in fertility preferences.

Table 3 also indicates that women who live in Bogotá —which is the capital and most populated city in the country with more than six million people— have the smallest average difference between the preferred and the actual number of children. By socioeconomic strata, the rate of *success* is higher among women of upper socioeconomic position.

We also confirm that unintended children are negatively related to the mother's as well as the father's education; Women whose partners have no education have more than two unplanned children while this number falls to 0.55 when their partners have attended the university. Women with no education have on average 5,2 times more unintended children, with respect to women with higher education (see Table 3). As can be seen from Figure 2, women's years of schooling and the number of unintended children are negatively related. Moreover, the opportunity cost of childbearing is evident in that more educated women wish to have fewer children, in comparison to the less educated women in our sample. While 2,8% of non-educated women do not want to have children, this value is 3,8% in the case of women with higher education. The proportion of women that who would like to have more than five children, decreases as the level of education increases: 15% of women

without education want to have five children or more, while in the case of the most educated women, this value is less than 1%.

Figure 2. Unintended number of children and years of education in Colombia.



Source: DHS – Macro International, 2005.

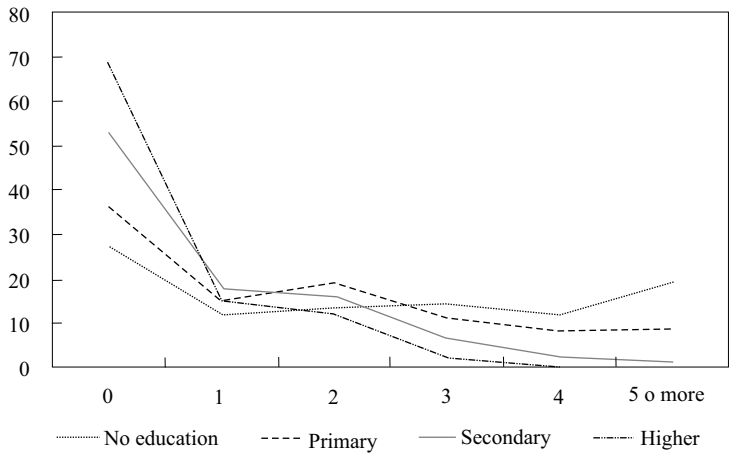
Finally, the distribution of unplanned children per educational level indicates success ($Yi = 0$) in 70% of women with higher education and 30% in women without education (Figure 3). The inverse relation between unintended children and schooling denotes high *success* among highly-educated women. The possible causes will be studied in the next section.

C. Empirical results

Our empirical approach begins with the estimation of our model by four different econometric methodologies (PRM, NBRM, ZIP and ZINB) (see detailed results in appendix 2). As it was mentioned above, Poisson Regression Model (PRM) and Negative Binomial Regression Model (NBRM) differ from the Zero Inflated models (ZIP and ZINB) in that the latter appear more suitable in the presence of excess zeros. All the

models estimated exhibited the same sign in the estimated coefficients and similar levels of significance. We use two approaches for selecting the best econometric specification. First, we compare the plots of the differences between the observed and predicted values of Y_i for each model (Models 1 to 4) and for each specification (PRM, NBRM, ZIP and ZINB). The results, which can be seen in appendix 3, indicate that ZIP and ZINB exhibit a better fit. Second, we use both the Akaike and Schwartz Bayesian information criteria (AIC and BIC, respectively) and Voung´s likelihood ratio test, (see appendix 4). Our findings suggest that the ZINB and ZIP models are the preferred model specifications[7].

Figure 3. Unintended number of children and women's education level in Colombia.



Source: DHS – Macro International, 2005.

Table 4 summarizes four different specifications for the ZIP and ZINB models. The first two models include educational levels by using dummy variables, but the two models differ in the use of the socio-economic variable; the former uses the assets index and the latter uses the 'socioeconomic strata'. The last two models include years of education instead, and as in the two previous cases, they use distinct socioeconomic variables.

[7] Appendix 4 summarizes these tests: Panel i compares PRM vs. the rest of methodologies. Panel ii does it for NBRM vs Zero Inflated Models and panel iii compares ZIP vs. ZINB models.

Table 4. Results of the Poisson and negative binomial regression models (semi-elasticities).

Dependent variable: Yi= Realized – Desired fertility	Model 1		Model 2		Model 3		Model 4	
	ZIP	ZINB	ZIP	ZINB	ZIP	ZINB	ZIP	ZINB
Education in single years	-	-	-	-	-4	-4	-4,5	-4,5
	-	-	-	-	-(9,46)	-(9,37)	-(10,78)	-(10,63)
Primary	-6,5	-6,6	-9,6	-9,7	-	-	-	-
	-(1,61)	-(1,6)	-(2,43)	-(2,39)	-	-	-	-
Secondary	-25,4	-25,5	-29,1	-29,3	-	-	-	-
	-(5,9)	-(5,82)	-(7,0)	-(6,86)	-	-	-	-
Higher	-39,8	-40	-45	-45,2	-	-	-	-
	-(5,34)	-(5,29)	-(6,32)	-(6,24)	-	-	-	-
Current age	13,9	13,8	10,6	10,3	17,7	17,7	15	14,9
	(0,78)	(0,76)	(0,6)	(0,57)	(0,97)	(0,96)	(0,83)	(0,81)
Age squared	-0,1	-0,1	-0,1	-0,1	-0,2	-0,2	-0,1	-0,1
	-(0,63)	-(0,61)	-(0,46)	-(0,43)	-(0,84)	-(0,82)	-(0,7)	-(0,68)
Live rural	18,4	18,6	15,7	16	17,5	17,7	14,9	15
	(5,51)	(5,44)	(4,76)	(4,68)	(5,27)	(5,23)	(4,53)	(4,47)
Asset index	-18,8	-18,9	-	-	-17,3	-17,3	-	-
	-(6,87)	-(6,8)	-	-	-(6,24)	-(6,19)	-	-
Socio-economic strata	-	-	-4,6	-4,7	-	-	-3,6	-3,7
	-	-	-(1,38)	-(1,36)	-	-	-(1,09)	-(1,08)
Marital duration	-1,0	-1,0	-1,0	-1,0	0	0	-0,1	-0,1
	-(0,03)	-(0,05)	-(0,07)	-(0,09)	-(0,01)	-(0,02)	-(0,05)	-(0,07)
Married	1,6	1,6	0,4	0,4	1,2	1,2	0	0
	(0,48)	(0,46)	(0,13)	(0,11)	(0,36)	(0,35)	(0,01)	-(0,01)
External shock (divorce or widowhood)	-1,4	-1,4	-2,1	-2	-2,3	-2,2	-2,9	-2,9
	-(0,24)	-(0,23)	-(0,36)	-(0,34)	-(0,38)	-(0,37)	-(0,49)	-(0,48)
Knowledge of contraception	16	16,1	14,7	14,8	16,5	16,6	15,1	15,2
	(0,76)	(0,75)	(0,7)	(0,68)	(0,78)	(0,78)	(0,72)	(0,71)
Use of contraception	-16,3	-16,3	-17	-16,9	-15,4	-15,4	-15,9	-15,8
	-(2,58)	-(2,51)	-(2,7)	-(2,59)	-(2,43)	-(2,38)	-(2,5)	-(2,43)

Continued

Table 4. Results of the Poisson and negative binomial regression models (semi-elasticities).

Dependent variable: Yi= Realized – Desired fertility	Model 1		Model 2		Model 3		Model 4	
Age at the first son	-6,8	-6,8	-6,8	-6,9	-6,6	-6,6	-6,6	-6,6
	-(13,28)	-(13,06)	-(13,33)	-(13,04)	-(12,84)	-(12,66)	-(12,83)	-(12,6)
Peer effect	13	13,1	10,8	10,8	12,3	12,3	10,9	10,9
	(6,01)	(5,92)	(2,48)	(2,42)	(5,69)	(5,63)	(2,52)	(2,47)
Body mass index	-0,5	-0,5	-0,6	-0,6	-0,5	-0,5	-0,6	-0,6
	-(1,66)	-(1,63)	-(2,12)	-(2,08)	-(1,65)	-(1,64)	-(2,07)	-(2,04)
Constant	-81,8	-81,5	-54,7	-52,2	-90,6	-90,6	-80,9	-80,6
	-(0,45)	-(0,44)	-(0,21)	-(0,19)	-(0,63)	-(0,62)	-(0,44)	-(0,43)
N	5181	5181	5181	5181	5181	5181	5181	5181
Ll	-7824,34	-7823,86	-7854,42	-7853,31	-7810,32	-7810,08	-7835,24	-7834,60

Source: DHS – Macro International, 2005. t-statistic in parentheses.
Semielasticities are obtained by (exp(BX)-1*100).

All the specifications used are equally robust and the sign of the coefficients are the same. From these, we can extract some interesting findings.

As we expected, after controlling for all the variables mentioned, we find a negative (and statistically significant) relationship between education and the unintended children. Table 4 summarizes the semi-elasticities obtained from the estimated coefficients. High human capital (measured by levels or years of schooling) is negatively related to the number of unintended children. Higher success in achieving the desired fertility among most educated people arises from their wider knowledge of the future cost of children. As we expected, the value of the semi-elasticity is greater in absolute value in women with higher education than in women with basic education. The fact of having achieved primary education reduces in 6,5% the number of unintended children; this percent in the cases of secondary and higher education are 25,4% and 39,8% respectively.

The relationship between unintended births and the mother's education may be explained by the interaction of different factors: first, more

educated women tend to postpone motherhood. Thus, in the case of women with the high education levels, it would be reasonable to find that they start to have children later (in comparison to less-educated women), which reflects the fact that they have less *time* to have children and hence, lower likelihood of making a mistake in the preferred number of children. Besides —as we mentioned above— more educated women would like to have fewer children (as a consequence of the effect of education on women's preferences).Second, the opportunity cost of having children is higher for more educated women, which could explain not only their preference for smaller families, but also their use of birth control methods in order to achieve the exact number of desired children. Third, these facts may be reinforced taking into account that educational levels of women and their partners' tend to be similar.

People living in rural areas seem to be more exposed to risk than those in urban populations. According to the semi-elasticities estimated, living in these zones increases unintended children by about 16,7% under both methods (ZIP and ZINB). This may be explained taking into account cultural conditions in rural areas: first, in rural areas we find a male dominated culture where the woman's role is different than in urban zones. Second, in rural areas women tend to have more children since kids are seen as inputs in the home's production function (*i.e.* daughters help with domestic chores and sons help with land labor). As a result, even if a rural woman preferred fewer children, her expectations may not fit the effective number of children because of factors associated to the culture in those zones.

The set of variables used for controlling the socioeconomic level of respondents (socioeconomic strata or assets index) have the expected sign but they are not always statistically significant in the case of socioeconomic strata. This can be a result of small differences in the stratification. For example, there are no considerable differences between physical conditions and neighborhoods from strata 6 or 5. In Colombia, the population in the highest quintile of income belongs to strata 5^{th} and 6^{th}. As we expected, the fact of being in a higher socioeconomic position could contribute to the reduction in unintended births, but this effect is possibly captured by the knowledge of contraceptive methods and higher access to them.

One interesting finding is that women who start their motherhood later reduce their risk of having more unintended children. This may lead to some policy recommendations because if some kind of program is designed in order to delay the age at which motherhood starts, we can reduce the risk of unintended children. It is common to find that women from low income deciles have on average more children and starts their motherhood earlier than higher income ones. Here it is important to note that neither marital duration nor marital status explain our dependent variable.

In order to assess the effect of adverse external shocks on preferences, we include our dummy 'shock' as we have previously defined. None of the external shocks included (divorce or widowhood) seem to be significant. These variables could also give us some ideas about changes in preferences over women's lifecycle. However, it is not possible to know the timing of the event, which prevents us from deriving conclusions that the existence of that shock induces women to change their demand for children.

Finally, in order to isolate the effect of education on our dependent variable from the knowledge and use of contraception, we include two variables, the answer to questions about the use and the knowledge of contraception methods. We find that people who report that they have used some contraception method, have more success in their final family size.

III. Concluding remarks

Our findings confirm the hypotheses that the more educated the women are, the smaller the number of unintended children they will have. Our findings give us some important policy implications. As we mentioned in the previous section, risk exposure is higher in women from rural areas and with lower human capital levels. Thus, public policy should focus on programs that give more information about consequences and implications of reproductive behavior for those out of the formal educational system. The challenge is to delay the motherhood in young women by increasing the available information that can help them make decisions using cost-benefit analysis. These should be comple-

mented with the use of information and communications technologies such as internet, mobile and television to provide assistance to remote populations who do not have access to formal education. Although fertility rates have decreased during the last decades, it is important to provide more information about the public and private initiatives that try to help adult women who have already finished their basic education. This point is especially important if we take into account the fact that there is not enough coverage of higher education in remote areas. Our findings are starting points in the study of the implications of unintended children on poverty and economic inequality.

In this sense, the conjunction of more public focalized programs and more efforts that enhance, for instance, school attendance could not only reduce the number of unintended children in rural areas, but it could also help to improve public health. Given the positive externalities of education, we could expect this kind of policies to have intergenerational effects. As a result, less educated women who can be benefited by these policies not only would have less unintended births, but also would be able to afford better conditions for their offsprings.

However, these types of efforts face at least one considerable constraint. Since most Colombians are Catholic, their beliefs can impede them to use some contraception methods.

Special attention is needed in the young population because of the possible intergenerational effects that unintended births may have on their standard of living. Young women with unintended children quit studying and since they do not study, they cannot afford a better quality of life for their children. This fosters a vicious circle of poverty for their children, which should be broken.

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Appendix

Appendix 1. Descriptives.

Variable	Definition	Obs.	Mean	Std. Dev.	Min.	Max.
Age	Age in years	5567	44,34	2,87	40	49
Rural	Dummy equal to one if she lives in rural areas	5567	0,22	0,41	0	1
Years of schooling		5567	6,83	4,30	0	19
Peer efect	Average of total children in their environment (socioeconomic strata and region)	5567	3,87	0,69	2,25	6,28
Asset index	Index from 0 to 6 of total of durable goods owned by the household (TV, telephone, radio, refrigerator, car)	5567	0,48	0,50	0	1
Socioeconomic strata	Index from 1 (worst) to 6 (best)	5567	1,95	0,95	0	5
Primary ed.	Dummy equal to one if her highest education level is primary	5567	0,43	0,50	0	1
Secondary ed.	Dummy equal to one if her highest education level is secondary	5567	0,40	0,49	0	1
Higher ed.	Dummy equal to one if she /he has attended a tertiary education institution	5567	0,11	0,32	0	1
Marital duration (years)	Number of years since she got married	5567	23,80	5,95	1	37
Marital status	Dummy equal to one if she is married or living together	5567	0,72	0,45	0	1
External shock	Dummy equal to one if she is widowed or divorced.	5567	0,06	0,24	0	1
Know and use contraception	Do you know and use any contraception method?	5567	2,92	0,48	0	3
Use contraception	Do you use contraception methods?	5567	0,97	0,16	0	1
Age at the first son	years	5567	21,31	4,25	11	43
BMI	Body mass index	5567	27,34	4,93	15,48	50

Source: DHS – Macro International, 2005.

Appendix 2. Estimated coefficients of count data models.

	Model 1				Model 2				Model 3				Model 4			
Variable	**PRM**	**NBRM**	**ZIP**	**ZINB**	**PRM**	**NBRM**	**ZIP**	**ZINB**	**PRM**	**NBRM**	**ZIP**	**ZINB**	**PRM**	**NBRM**	**ZIP**	**ZINB**
Current age	1,21	1,16	1,14	1,14	1,20	1,13	1,11	1,10	1,24	1,21	1,18	1,18	1,23	1,18	1,15	1,15
	1,34	0,77	0,78	0,76	1,25	0,63	0,6	0,57	1,51	0,95	0,97	0,96	1,43	0,84	0,83	0,81
Age squared	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
	-1,15	-0,63	-0,63	-0,61	-1,08	-0,50	-0,46	-0,43	-1,35	-0,82	-0,84	-0,82	-1,28	-0,72	-0,70	-0,68
BMI	1,00	1,00	1,00	1,00	1,00	1,00	0,99	0,99	1,00	1,00	1,00	1,00	1,00	1,00	0,99	0,99
	-1,61	-0,98	-1,66	-1,63	-2,25	-1,49	-2,12	-2,08	-1,59	-1,01	-1,65	-1,64	-2,20	-1,48	-2,07	-2,04
Rural	1,18	1,20	1,18	1,19	1,14	1,16	1,16	1,16	1,17	1,19	1,18	1,18	1,13	1,15	1,15	1,15
	6,13	4,64	5,51	5,44	4,91	3,77	4,76	4,68	5,74	4,40	5,27	5,23	4,55	3,55	4,53	4,47
Years of schooling	-	-	-	-	-	-	-	-	0,95	0,95	0,96	0,96	0,94	0,94	0,96	0,96
	-	-	-	-	-	-	-	-	-15,00	-11,25	-9,46	-9,37	-17,02	-12,73	-10,78	-10,63
Primary ed.	0,94	0,93	0,94	0,93	0,90	0,89	0,90	0,90	-	-	-	-	-	-	-	-
	-1,73	-1,31	-1,61	-1,60	-2,63	-1,93	-2,43	-2,39	-	-	-	-	-	-	-	-
Secondary ed.	0,69	0,69	0,75	0,75	0,65	0,65	0,71	0,71	-	-	-	-	-	-	-	-
	-8,30	-5,79	-5,90	-5,82	-9,81	-6,78	-7,00	-6,86	-	-	-	-	-	-	-	-
Higher ed.	0,52	0,52	0,60	0,60	0,47	0,47	0,55	0,55	-	-	-	-	-	-	-	-
	-9,38	-7,18	-5,34	-5,29	-10,92	-8,35	-6,32	-6,24	-	-	-	-	-	-	-	-
Asset index	0,78	0,78	0,81	0,81	-	-	-	-	0,80	0,80	0,83	0,83	-	-	-	-
	-9,66	-7,27	-6,87	-6,80	-	-	-	-	-8,79	-6,57	-6,24	-6,19	-	-	-	-
Socioeconomic strata	-	-	-	-	0,94	0,92	0,95	0,95	-	-	-	-	0,95	0,93	0,96	0,96
	-	-	-	-	-2,09	-1,94	-1,38	-1,36	-	-	-	-	-1,78	-1,68	-1,09	-1,08
Marital duration (years)	1,00	0,99	1,00	1,00	1,00	0,99	1,00	1,00	1,00	0,99	1,00	1,00	1,00	0,99	1,00	1,00
	0,09	-0,42	-0,03	-0,05	-0,07	-0,46	-0,07	-0,09	0,19	-0,38	-0,01	-0,02	0,03	-0,42	-0,05	-0,07

Continued

Appendix 2. Estimated coefficients of count data models.

Marital status	1,05	1,04	1,02	1,02	1,03	1,02	1,00	1,00	1,04	1,04	1,01	1,01	1,03	1,02	1,00	1,00
	1,54	1,00	0,48	0,46	0,95	0,53	0,13	0,11	1,44	0,93	0,36	0,35	0,91	0,49	0,01	-0,01
External shock	1,07	1,07	0,99	0,99	1,07	1,07	0,98	0,98	1,07	1,06	0,98	0,98	1,06	1,06	0,97	0,97
	1,30	0,97	-0,24	-0,23	1,22	0,89	-0,36	-0,34	1,22	0,86	-0,38	-0,37	1,17	0,78	-0,49	-0,48
Know and use contraception	1,17	1,18	1,16	1,16	1,15	1,16	1,15	1,15	1,19	1,20	1,17	1,17	1,16	1,18	1,15	1,15
	0,92	0,70	0,76	0,75	0,81	0,61	0,70	0,68	1,00	0,74	0,78	0,78	0,90	0,67	0,72	0,71
Use contraception	0,88	0,91	0,84	0,84	0,85	0,89	0,83	0,83	0,89	0,92	0,85	0,85	0,87	0,90	0,84	0,84
	-2,05	-0,96	-2,58	-2,51	-2,48	-1,18	-2,70	-2,59	-1,84	-0,86	-2,43	-2,38	-2,19	-1,06	-2,50	-2,43
Age at the first son	0,91	0,91	0,93	0,93	0,91	0,91	0,93	0,93	0,92	0,91	0,93	0,93	0,92	0,91	0,93	0,93
	-21,12	-16,03	-13,28	-13,06	-21,31	-16,00	-13,33	-13,04	-20,31	-15,52	-12,84	-12,66	-20,41	-15,43	-12,83	-12,60
Peer efect	1,21	1,21	1,13	1,13	1,17	1,15	1,11	1,11	1,20	1,20	1,12	1,12	1,17	1,15	1,11	1,11
	10,39	7,36	6,01	5,92	4,17	2,62	2,48	2,42	9,85	7,09	5,69	5,63	4,09	2,64	2,52	2,47
Constant	0,03	0,08	0,18	0,19	0,07	0,23	0,45	0,48	0,02	0,04	0,09	0,09	0,04	0,09	0,19	0,19
	-1,06	-0,57	-0,45	-0,44	-0,85	-0,32	-0,21	-0,19	-1,21	-0,73	-0,63	-0,62	-1,02	-0,53	-0,44	-0,43
Statistics																
alpha	-	0,54	-	-	-	0,56			-		-	-	-		-	-
N	5.181	5.181	5.181	5.181	5.181	5.181	5.181	5.181	5.181	5181	5181	5181	5181	5181	5181	5181
ll	-8.415,78	-8.033,85	-7.824,34	-7.823,86	-8.461,02	-8.058,16	-7.854,42	-7.853,31	-8.393,72	-8.022,93	-7.810,32	-7.810,08	-8.431,32	-8.042,98	-7.835,25	-7.834,61
bic	16.968,41	16.213,10	15.922,37	15.929,97	17.058,88	16.261,72	15.982,53	15.988,86	16.907,18	16.174,15	15.860,12	15.868,19	16.982,38	16.214,26	15.909,97	15.917,24
aic	16.863,57	16.101,70	15.712,69	15.713,73	16.954,04	16.150,32	15.772,84	15.772,62	16.815,44	16.075,85	15.676,64	15.678,16	16.890,64	16.115,96	15.726,49	15.727,21

t-statistic is shown under the coefficient

Note: For each model, it was estimated four specifications. PRM: Poison Regression Model, NBRM: Negative Binomial Regression Model, ZIP: Zero Inflated Regression Model, ZINB: Zero Inflated Negative Binomial

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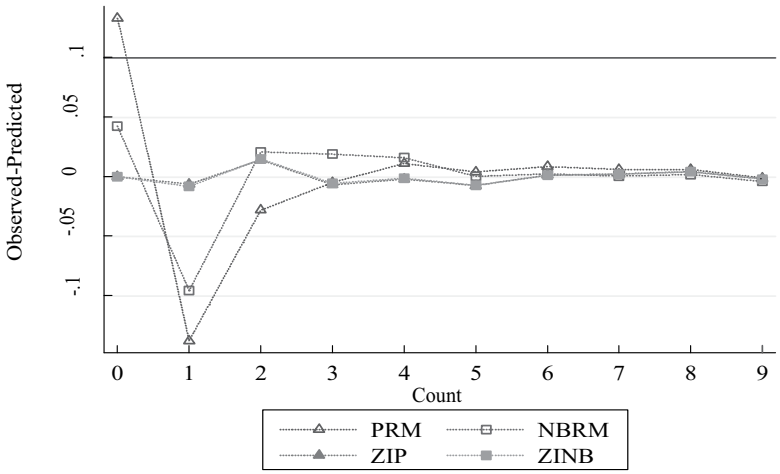
Appendix 3. Goodness of fit. Differences between observed-predicted values.

Model 1

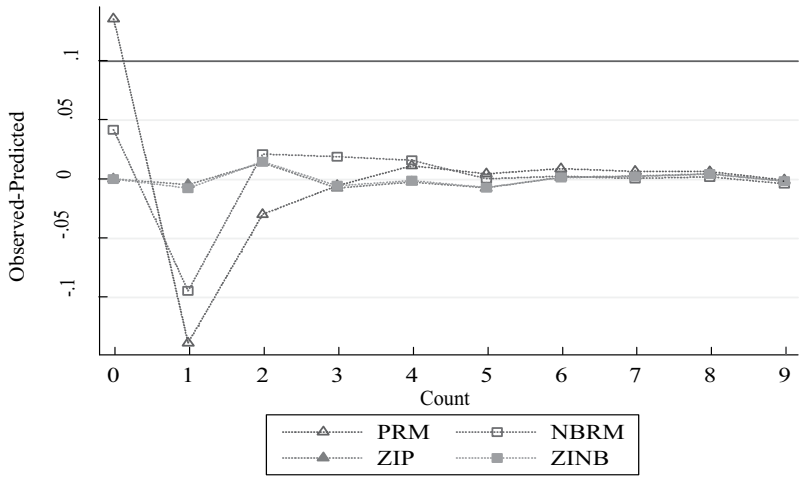
Note: positive deviations show underpredictions.



(a)

Model 2

Note: positive deviations show underpredictions.



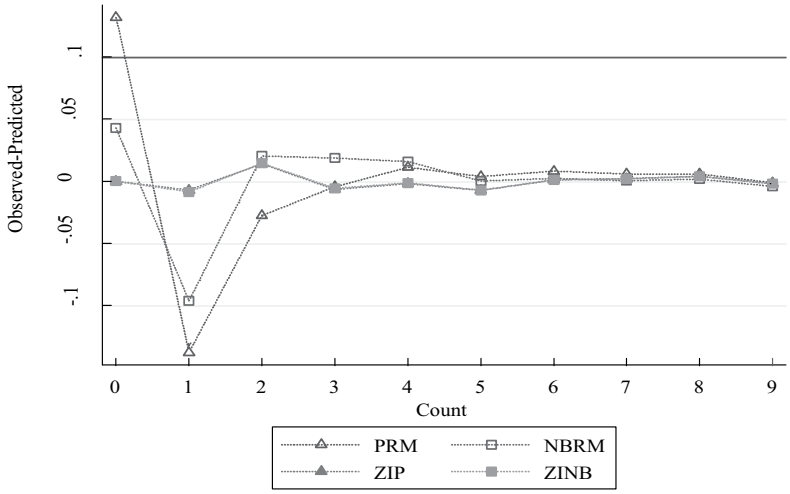
(b)

Continued

Appendix 3. Goodness of fit. Differences between observed-predicted values.

Model 3

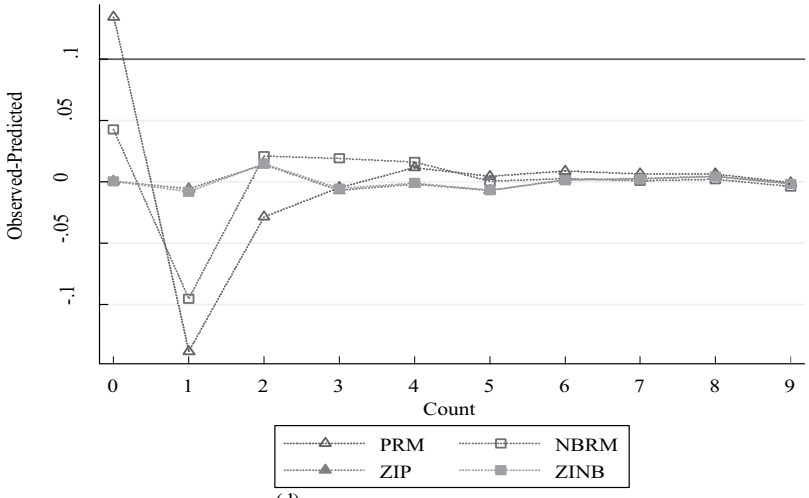
Note: positive deviations show underpredictions.



(c)

Model 4

Note: positive deviations show underpredictions.



(d)

Appendix 4. Information criteria test.

		Model 1				Model 2			
	PRM	BIC = -27343.40	AIC = 3.25	Prefer Over	Evidence	BIC = -27252.93	AIC = 3.27	Prefer Over	Evidence
	vs NBRM	BIC = -28098.72	AIC = 3.11	NBRM PRM	Very strong	BIC = -28050.10	AIC = 3.11	NBRM PRM	Very strong
(i)	vs ZIP	BIC = -28389.44	AIC = 3.03	ZIP PRM	Very strong	BIC = -28329.28	AIC = 3.04	ZIP PRM	Very strong
		Vuong = 16.39	prob = 0.00		p = 0.000	Vuong = 16.56	prob = 0.00	Prefer Over	p = 0.000
	vs ZINB	BIC = -28381.85	AIC = 3.03	ZINB PRM	Very strong	BIC = -28322.95	AIC = 3.04	ZINB PRM	Very strong
	NBRM	BIC = -28098.72	AIC = 3.11	Prefer Over	Evidence	BIC = -28050.10	AIC = 3.12	Prefer Over	Evidence
(ii)	vs ZIP	BIC = -28389.44	AIC = 3.03	ZIP NBRM	Very strong	BIC = -28329.28	AIC = 3.04	ZIP NBRM	Very strong
	vs ZINB	BIC = -28381.84	AIC = 3.03	ZINB NBRM	Very strong	BIC = -28322.95	AIC = 3.04	ZINB NBRM	Very strong
		Vuong = 11.58	prob = 0.00	ZINB NBRM	p = 0.000	Vuong = 11.44	prob = 0.00	ZINB NBRM	p = 0.000
	ZIP	BIC = -28389.44	AIC = 3.03	Prefer Over	Evidence	BIC = -28329.28	AIC = 3.04	Prefer Over	Evidence
(iii)	vs ZINB	BIC = -28381.84	AIC = 3.03	ZIP ZINB	Strong	BIC = -28322.95	AIC = 3.04	ZIP ZINB	Strong
		Model 3				**Model 4**			
	PRM	BIC = -27404.633	AIC = 3.246	Prefer Over	Evidence	BIC = -27329.436	AIC = 3.260	Prefer Over	Evidence
	vs NBRM	BIC = -28137.669	AIC = 3.103	NBRM PRM	Very strong	BIC = -28097.560	AIC = 3.111	NBRM PRM	Very strong
(i)	vs ZIP	BIC = -28451.696	AIC = 3.026	ZIP PRM	Very strong	BIC = -28401.846	AIC = 3.035	ZIP PRM	Very strong
		Vuong = 16.278	prob = 0.000	ZIP PRM	p = 0.000	Vuong = 16.411	prob = 0.000	ZIP PRM	p = 0.000
	vs ZINB	BIC = -28443.624	AIC = 3.026	ZINB PRM	Very strong	BIC = -28394.573	AIC = 3.036	ZINB PRM	Very strong
	NBRM	BIC = -28137.669	AIC = 3.103	Prefer Over	Evidence	BIC = -28097.560	AIC = 3.111	Prefer Over	Evidence
(ii)	vs ZIP	BIC = -28451.696	AIC = 3.026	ZIP NBRM	Very strong	BIC = -28401.846	AIC = 3.035	ZIP NBRM	Very strong
	vs ZINB	BIC = -28443.624	AIC = 3.026	ZINB NBRM	Very strong	BIC = -28394.573	AIC = 3.036	ZINB NBRM	Very strong
		Vuong = 11.654	prob = 0.000	ZINB NBRM	p = 0.000	Vuong = 11.540	prob = 0.000	ZINB NBRM	p = 0.000
	ZIP	BIC = -28451.696	AIC = 3.026	Prefer Over	Evidence	BIC = -28401.846	AIC = 3.035	Prefer Over	Evidence
(iii)	vs ZINB	BIC = -28443.624	AIC = 3.026	ZIP ZINB	Strong	BIC = -28394.573	AIC = 3.036	ZIP ZINB	Strong

Panel i compares PRM vs. NBRM, ZIP and ZINB. Panel ii does it for NBRM vs Zero Inflated Models and panel iii compares ZIP vs. ZINB models.
BIC: Schwartz Bayesian Information Criterion. AIC: Akaike information Criterion. Voung: Voung Test for nonnested models.