Effects of fertility on women's working status

Jaramillo, Miguel

Avances de Investigación

Metodologías de investigación y evaluación de políticas y programas sociales

Effects of fertility on women's working status

Miguel Jaramillo Baanante

20

35 Años GRADE
Grupo de Análisis para el Desarrollo

Effects of fertility on women's working status

Avances de Investigación 20

Effects of fertility on women's working status

Miguel Jaramillo Baanante[1]

1 Senior Researcher at the Group for the Analysis of Development - GRADE. I am grateful for superb research assistance from Veronica Montalva and Luciana de la Flor.

The publication was conducted with funds designated by the International Development Research Centre, Canada, through the Think Tank Initiative.

Lima, april 2016

GRADE, Group for the Analysis of Development
Av. Almirante Grau 915, Barranco, Lima, Peru
Phone: (51-1) 247-9988
Fax: (51-1) 247-1854
www.grade.org.pe

Research director: Santiago Cueto
Text and style edition: Natalie Povilonis
Edition assistance: Diana Balcázar T.
Cover design: Elena González
Design of layout: Amaurí Valls M.
Print: Impresiones y Ediciones Arteta E.I.R.L
Cajamarca 239 C, Barranco, Lima, Perú. Phone: (51-1) 247-4305 / 265-5146

Index

ABSTRACT

As in other developing countries, Peru's demographic transition is well underway. Concurrently, women's labor market participation and employment rates have substantially increased. In this paper we estimate the causal effect that the reduction in fertility rates has on women's employment using instrumental variables already tested in developed countries—twins in the first birth and the sex composition of the two oldest children. We also analyze the heterogeneity of the effects along three lines: marriage status of the mother, age of the first (second) child, and mother's level of education. We find strong effects of fertility. According to our results, 27 percent of the total increase in women's rate of employment between 1993 and 2007 can be attributed to the reduction in fertility rates. This is a considerable magnitude, more than four times as large as the estimate for US by Jacobsen et al. (1999). Effects are largest in women with children 2 years old or younger and decline inversely as the first child increases in age, but are still significant when he or she reaches 10. Effects also vary with the mother's education level, tending to be stronger when women have more education. Finally, these effects are smaller for married women than for all women.

Keywords: Fertility, labor market decisions, female labor, instrumental variables

JEL Classification: J13, J22.

INTRODUCTION

Most Latin American countries are well into their demographic transitions (CEPAL 2008). Resulting demographic changes, particularly declining fertility, can have substantial consequences on economic development. Macro studies on the role of demographic change in countries that have already advanced in their demographic transitions bring some striking, though controversial, results. For instance, Bloom and Williamson (1998) and Williamson (2001) have argued that demographic change, through the effect of a changing age composition on savings, explains as much as a third of East Asia's economic miracle[2]. Micro studies, on the other hand, have focused on fertility and other simultaneous household decisions concerning labor, savings, and human capital investments. Despite the fact that Latin America has experienced significant demographic changes during the last decades, the economic consequences of this phenomenon in countries of the region have not received much systematic attention.

Labor supply is one of the main channels through which demographic transition can generate economic benefits. Lower fertility rates have been causally associated with increases in female participation in the labor market (Jacobsen et al. 1999; Angrist and Evans 1998; Bronars and Grogger 1994; Hotz and Miller 1988; Rosenzweig and Schultz 1985; Rosenzweig and Wolpin 1980a). Problems with

2 See Schultz (2005) for a critique of this thesis.

the endogeneity of fertility have led these studies to look for instrumental variables in order to correctly estimate the effect of a child in labor supply. Well known methodologies such as those in Jacobsen et al. (1999) and Angrist and Evans (1998) estimate the effect through the birth of twins—where the second child is not planned—and the births of two children of the same sex—where parents looking for a boy-girl pair usually have another child. Both events have a significant random component and are largely independent of parenting decisions. Recent studies have gone further by trying to estimate the effect of a first child. Cristia (2008) used a sample of women who seek help to achieve pregnancy for the first time. He chose women who gave birth as the group of interest and those who did not achieve pregnancy as the control group. Results show that the first child reduces female employment by 26 percentage points. Newer approaches in developed countries have tried to improve these models by including childcare costs in the analysis. Examples of these estimations are found in Choné et al. (2003) and Gong et al. (2010).

For Latin America we have a handful of studies. Cruces and Galiani (2007), using the first two children of the same-sex as an instrumental variable for Mexico and Argentina, find that the effect of fertility on labor supply is similar to the one identified by Angrist and Evans (1998) for the US. Results are significant despite differences in fertility and female education levels, and in childcare facility supply in these countries. Caceres-Delpiano (2008) uses multiple births as instrumental variable on a DHS dataset covering 42 developing countries and finds a negative impact of family size on female employment. Furthermore, heterogeneity is identified by birth order (second births do not follow the negative relationship with employment) and type of employment (informal jobs are more sensitive to first births while at higher parities numbers, all jobs are affected). Other approaches in Latin America include Agüero and Marks (2008), which propose an alternative methodology based on infertility shocks. In contrast to most research, they find no effect of children on female employment.

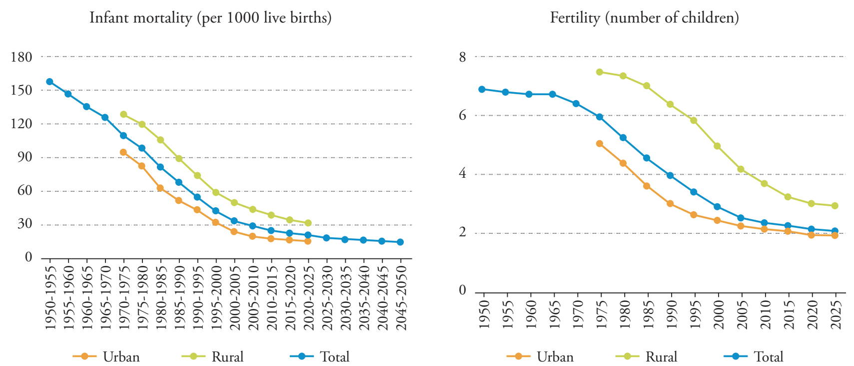
The purpose of this paper is to contribute to this literature by providing new evidence of the relationship between fertility and women's employment in Latin America. For this, we estimate the effect of fertility decline on Peruvian women's work at two points in the demographic transition (1993 and 2007), using census data for those years. In particular, we focus on the effect of the second and third child using three instrumental variables: twins at first birth, twins at second birth, and children of the same sex. We also analyze how lasting these effects are by identifying effects at different age points for the second and third child, respectively. Finally, we detail the heterogeneity of effects according to socioeconomic characteristics, given by the mother's level of education and marriage status. As we detail in the next section, while census data availability is key to our approach, it is also the case that the period for the analysis has all the features of the Peruvian demographic transition: crucially, women´s fertility decline and increase in labor participation.

The paper is organized as follows. Section 2 provides background information on Peru's demographic transition and labor market trends. Section 3 discusses the instrumental variable approach to causally link fertility decline and labor supply behavior. Section 4 presents our results and Section 5 concludes.

1. BACKGROUND: PERU'S DEMOGRAPHICS AND THE LABOR MARKET

Currently Peru is far along in its demographic transition, having gone from high to medium fertility and mortality rates. In effect, during the last four decades Peru has gone from population growth rates close to 3% in the seventies to 1,1% in the 2010s. Figure 1 presents the infant mortality and fertility trends and projections for periods 1950-2050 and 1950-2025, respectively. We can observe that infant mortality has declined sharply since the fifties, shrinking to one-fifth its original level during the first fifty years, and continuing to decline at a slower pace thereafter. At the same time, fertility has decreased noticeably since the mid-seventies, going from an average rate of six

Figure 1
Infant mortality and fertility, trends and projections



Source: Celade. Observatorio Demográfico Nº 4, 2008

Source: INEI, Perfil Sociodemográfico del Perú 2000.

children per woman to the current 2,6 children per woman. Thus, Peru has followed the classic pattern of the demographic transition, the fertility decline coming after the mortality decline.

Demographic trends can be observed in the labor market during the most recent decades. Figure 2 depicts significant changes in the age structure of the population and the working age population for the period 1997-2007. The share of prime-age working population, those aged 25-65, increased during the whole period, while the share of those below 15 years old decreased. These trends seem to accentuate after the turn of the century. On the other hand, the share of individuals aged 15-24 years old slightly declined (1 percentage point) and that of individuals aged over 65 remained relatively constant throughout the period. Consequently, the working age population shows an upward trend, increasing its size by about 4 million people and its share in total population by 4,5 percentage points in the decade.

Figure 2

Age structure of the population and working age population, 1997-2007

Data source: ENAHOs 1997-2007.

Data source: ENAHOs 1997-2007.

Within this context, participation rates of men and women reflect somewhat different patterns, as Figure 3 shows. Over the whole decade, the net increase in participation of men was 2 percentage points, while that of women was 4,7 percentage points. Employment rates follow the pattern of participation. The net increase in employment rates during the whole period was considerably greater for women than for men: 5,8 versus 2,6 percentage points.

Figure 3
Participation and employment rate by gender, 1997-2007

Data source: ENAHOs 1997-2007.

Data source: ENAHOs 1997-2007.

One question that naturally arises is about which factors are driving the increase in women's employment rate. Factors such as higher education levels and changes in cultural perceptions about the role of women likely have contributed to this trend. Another factor possibly behind this trend is the recent decline in fertility rates. Since traditionally women devote much more time to childcare than men, one may reasonably expect that the reduction in fertility in particular has increased the available time of women for work. In any case, assessing the role of fertility decline in women's enhanced participation in the labor market requires establishing the causal link between fertility and labor market behavior.

2. FERTILITY AND WOMEN'S WORK: METHODOLOGICAL ASPECTS

Microeconometric studies looking for a causal link between fertility and labor supply must face the problem that fertility and labor market decisions may be interrelated. In fact, they are most plausibly thought of as endogenously determined within the framework of household utility maximization (Rosenzweig and Wolpin 1980b, Schultz 2007, *inter alia*). As a result, identifying the causal effect of fertility on labor supply is not straightforward. One approach has been to estimate the determinants of fertility and labor supply using simultaneous equations (Hotz and Miller 1988, Rosenzweig and Schultz 1985). However, as Jacobsen et al. (1999) points out, the difficulty with this approach lies in finding plausible identifying restrictions in order to recover the structural parameters.

Exploiting exogenous sources of variation in family size has been the preferred microeconometric approach to estimate the causal link between fertility and work. Mainly, two instrumental variables have been proposed: the occurrence of twins in the first or second birth (Jacobsen et al. 1999; Angrist and Evans 1998; Bronars and Grogger 1994; Rosenzweig and Wolpin 1980a) and the sex mix of a family's two oldest children (Angrist and Evans 1998). The major advantage of both instrumental variables is that these events affect fertility outcomes and their occurrence is (almost) randomly distributed among women who have at least one or two children. Thus, they provide natural experiments for studying the effects of exogenous fertility variations on labor supply.

We are interested in estimating the causal effect of fertility on labor market outcomes. Thus, our structural equation is as follows:

$$Y_i = \alpha_0 + \alpha X + \beta KIDS_i + u_i \ldots(1),$$

Where i indexes individual observations, *Y* is the labor outcome of interest, KIDS is the total number of children, and *X* is the matrix of other covariates. We expect KIDS to be an endogenous variable—that is, we expect the variable KIDS to be correlated with the error term that includes preferences for children and/or for work. Therefore, estimation of equation (1) using the ordinary least squares (OLS) methodology would lead to inconsistent estimates of the parameter of interest β.

The use of an adequate instrumental variable for the endogenous variable KIDS allows us to obtain a consistent estimate of β. An adequate instrumental variable must satisfy two basic requirements: (1) it must be partially correlated with the endogenous explanatory variable and (2) it must be uncorrelated with the error term of the structural equation (Wooldridge 2002). Although criterion (1) can be empirically tested, criterion (2) cannot. Therefore, we should be careful in selecting our instrumental variables.

Our first set of instrumental variable is the occurrence of twins in the first and second birth. We prefer these births because they provide the most plausible approximation to exogenous variations in fertility. In addition, by considering two variables we can isolate the effect of a second and a third child. This estimation is superior to one using twins in *any* birth since the incidence of a twin in these cases is related to the desired number of children. First, women with more births would be overrepresented and results could reflect a relationship between greater desired fertility and labor supply. Second, the per-pregnancy probability of twins seems to increase with number of births (Rosenzweig and Wolpin 1980a). Thus, a variable of twins in any birth would capture not only an additional unplanned child, but also preferences for children and/or for labor supply. We can address this problem partially by using the variables twins in first and second birth. However, we should keep in mind that the probability of having twins increases with the age of the mother and hence we need to control for this variable (Mittler 1971). Also, the sample must be constrained to women having at least one child for the "twins-first" strategy since twins in the first birth allows identification of the marginal effect of an additional child given the presence of one child, but it does not identify the effect of having one child compared to having none. And the same criterion applies for the sample of twins in the second birth: it should consider only women having at least two children.

Our second instrument is the sex mix of the two oldest children. The sex mix of the two oldest children influences parental preferences for a third child since parents of same-sex siblings are significantly more likely to have a third child (Williamson 1976). Because of the nature of this instrumental variable, the sample must be constrained to women with at least two children.

Do the proposed variables meet the required criteria for being adequate instruments for KIDS? The first requirement is that an instrumental variable must partially correlate with the endogenous explanatory variable—KIDS, in our case. The first two proposed instrumental variables, having twins in the first and second birth, have an immediate effect on the number of children a woman has. However, women can adjust their subsequent fertility behavior and if their desired number of children is at least two children, such an event may not affect their total fertility rate in the long run. Nonetheless, the short run effect is unavoidable. At the same time, we expect that the likelihood of having a third child is higher for women whose first two children are of the same sex than for women whose first two children are of different sexes. Empirical evidence supports this claim (Williamson 1976; Angrist and Evans 1998; Cruces and Galiani 2007). Thus, there are good reasons to believe that all our instrumental variables fulfill criterion (1). In addition, this can be empirically tested.

The second requirement states that the instrumental variable must be uncorrelated with the error term of the structural equation. Although this criterion cannot be tested empirically, we have good arguments to believe that all instrumental variables meet it. The occurrence of twins in the first and second birth and the sex composition of the two oldest children are to a great extent randomly distributed among women having at least one or two children, respectively. In particular, these outcomes are randomly distributed with respect to most household characteristics that may relate to labor force participation, and we can easily control for those that are not, such as the mother's age at first birth (Jacobsen et al. 1999; Angrist and Evans 1998; Rosenzweig and Wolpin 1980a). Since the outcomes of the instrumental variables are randomly distributed among women after adequately controlling for certain variables, we can confidently expect that all variables are uncorrelated with the error term of the structural equation.

Hence, our basic econometric approach involves estimating equation (1) using the occurrence of twins in the first and second birth and the sex composition of the two oldest children as instrumental variables. Following Angrist and Evans (1998), the covariates included in the model are the mother's age, the mother's age at first birth, and the sex of the first child. In the case of the sex mix variable, we also include the sex of the second child. Mother's age controls for the fact that older women tend to have more children. We include sex of the first (second) child because if there is preference for male children, then women whose first (second) child is female will probably have more children than women whose first (second) child is male. The inclusion of mother's age at first birth is crucial since the probability of twins varies with this variable; thus, we need to control for it[3].

Data and descriptive analysis

Data used in this paper come from Peru's *Censo Nacional de Población y Vivienda* 'National Population and Housing Census' 1993 and 2007, which provide information on the family size and current working status of all interviewed women[4]. Our methodology entails a major data requirement, which the size of these datasets solves. The censuses from 1993 and 2007 contain a total of 5,099 million and 7,271 million households, respectively. Naturally, our final sample size is smaller due to several adjustments made in order to obtain a sample appropriate for our purposes. We restricted our sample to mothers between 15 and 49 whose oldest child was 25 years old or younger. Restricting the child's age allows for a sample made only of children living at home. In Peru, children tend to live with their parents longer than 18 years, which is the cut-off age in Angrist and Evans (1998). Also, children over 25 who stay in the household are likely contributing to the family's finances. Excluding them from the sample is therefore necessary.

Besides this general age restriction, we define our estimation samples according to the methodology. First, for the "twins-first"

3 We ran alternative regressions that include the mother's education level as a control. Results are substantially the same.

4 They do not provide information on either hours worked or income earned.

strategy, we restricted the sample to women with at least one child alive (at the time of the interview) and no triplets. Not doing so could lead to interpretation of the effect of triplets as a second child. For the "twins-second" strategy, we restricted the sample to women with at least two children alive (at the time of the interview) and no triplets. Finally, for the "sex-mix" strategy, we restricted the sample to women whose two oldest children were alive and who had no twins in the second birth. The birth of a third child in the latter case would not be explained by the same-sex of the first two children, and therefore can distort the strategy. After these adjustments, we obtained the sample sizes reported in Table 1. Descriptive statistics are in Appendix 1.

Table 1
Sample sizes by methodological strategy and data source

Strategy	Census 1993	Census 2007
"Twins-first"	1 710 171	2 236 263
"Twins-second"	1 335 386	1 579 351
"Same-sex"	1 312 485	1 567 263

Source: Census 1993 and 2007.

In addition, for each methodological strategy, we used a married subsample formed by women who reported themselves married at the time of the census. From the sample of women with children under 26 in 1993, 61,9% were married. In 2007, only 41,7% reported as married in the same demographic group. The trend points towards more informal couple arrangements.

There is no retrospective information on female fertility in the censuses. For each member of the household, the relationship to the head of household is detailed. This means that for female heads of household we have direct identification of all their children living in the household. For those women that report themselves wives or couples of the household head we made sure that the number of children each reports is identical to the number of children in the household; otherwise they were excluded from the sample.

Census data are informative of the continuing demographic transition in the period, as shown in Table 2. In 1993 half of women between 15 and 49 years old had one or two children while slightly more than a quarter had 4 or more. A decade and a half later, two thirds had one or two children, while a still significant 14,1% had 4 or more. These numbers contrast with those from the 1981 census, where 40,2% of women had one or two children while 39% had 4 or more children. Figure 4 shows the distribution of the number of children per mother in the 1993 and 2007 censuses.

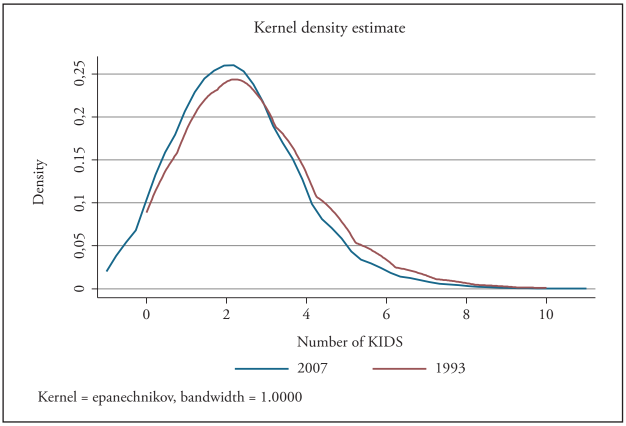
Table 2
Distribution of mothers according to their number of children

Number of children	1981	1993	2007
1 child	17,5%	21,92%	29,38%
2 children	22,7%	29,43%	36,26%
3 children	20,8%	22,15%	20,25%
4 or 5	26,7%	20,13%	11,82%
6 or more	12,3%	6,38%	2,29%
Total	100%	100%	100%

Note: Only women ages 15-49 whose first child is 25 years old or younger are considered.

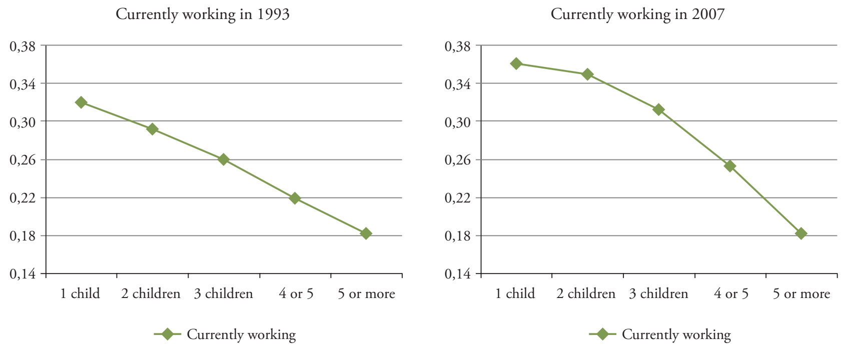
Source: 1981, 1993 and 2007 Censuses

Figure 4
Distribution of children per mother, 1993 and 2007



To motivate our analysis, we explore female employment according to number of children (see Figure 5). The graph on the left shows the proportion of women working in 1993—i.e., those who had a job at the time of the interview—and graph on the right shows the proportion of women working in 2007. As expected, we observe a negative association between number of children and employment status: women with more children are less likely to work. The probability of working despite having children did increase between years, especially with two or fewer children. This is consistent with women's increasing participation rates.

Figure 5
Women's labor market participation and number of children



Note: Only women ages 15-49 whose first child is 25 years old or younger are considered.

Note: Only women ages 15-49 whose first child is 25 years old or younger are considered.

Also, we estimate the correlation between number of children and working status through OLS regressions. Table 3 shows these results for having more than one child (columns 1 and 3) and having more than two children (columns 2 and 4). There are four main results. First, the presence of a second child is associated with a reduction in the probability of working by 3,7 percentage points in 1993 and 4,7 percentage points in 2007. Second, results for the presence of a third child suggest that the decrease is smaller than the one for a second child, about 3,3 percentage points in 1993 and 4,0 percentage points in 2007, indicating that a second child has bigger effects on women´s work than a third child. Third, for all cases, the effects are larger in 2007 than in 1993. Finally, for every case, the married subsample shows smaller point estimates on the probability of working.

Table 3
OLS Estimates of the relationship between fertility and women's work

OLS Estimates of fertility on labor supply using KIDS as independent variable (without considering it endogenous nature)

	Census 1993		Census 2007	
Independent variable	More than 1 child (1)	More than 2 children (2)	More than 1 child (4)	More than 2 children (5)
All women				
KIDS	-0,037***	-0,033***	-0,047***	-0,040***
	(0,000)	(0,000)	(0,000)	(0,000)
Observations	1 710 171	1 335 386	2 236 263	1 579 351
Married women				
KIDS	-0,028***	-0.028***	-0,037***	-0,036***
	(0,000)	(0,000)	(0,000)	(0,000)
Observations	1 057 916	874 062	931 572	740 756

Standard errors in parentheses. ***p<0,01, **p<0,05, *p<0,1. Sample for more than 1 child: Women between 15 and 49 years old who have at least one child (no triplets) and consistent data about number of children, whose children are between 0 and 25 years old. Sample for more than 2 children: Women between 15 and 49 years old who have at least two children (no triplets) and consistent data about number of children, whose children are between 0 and 25 years old.

3. RESULTS

We measure the effect of the number of children on labor market outcomes of women using three different instrumental variables for the endogenous variable KIDS. Specifically, we measure the effect of the second and the third child through "twins-first" (twins in first birth), "twins-second" (twins in the second birth), and "same-sex" (two oldest children are of the same sex) variables. For each of them we define a separate subsample with specific characteristics.

Appendix 1 contains tables of descriptive statistics for all relevant variables of the three subsamples. The probability of twinning and having same-sex kids provides some evidence of the instruments' quality. They are all comparable to estimates in the literature. Twinning probability in the first birth was 0,0076 in 1993 and 0,0072 in 2007. The probability of having twins did not change over the years. One concern about using twins as an exogenous shock nowadays is the appearance of fertility treatments such as IVF. These increase the twinning probability and thus can potentially ruin the exogenous component of the instrument. However, a constant twinning probability implies that it remained exogenous. For the whole sample of the "twins-second" methodology, we find that twinning probability in second birth is 0,0076 for 1993 and 0,0075 for 2007. Finally, the probability of having same-sex children is 0,05034 in 1993 and 0,5032 in 2007.

Tables 3 and 4 show first-stage results for each of the instrumental variables in each year. We find positive and significant correlations between the "twins-first" instrument and the number of children. Women with twins in their first pregnancy have 0,60 additional children. This result varies when considering the age of the first child. When the first child is 2 years old or younger, women with twins have 0,88 additional children. As children get older, mothers of twins have more time to approximate the number of children they have to what they desire. The mothers without twins eventually catch up and reach a number of children similar to those with twins. This is also true for mothers of twins in the second birth, who have 0,95 more children when the twins are younger than 2 years old.

"Same-sex" instruments are also positively and significantly correlated with the number of children. Women whose first two children are of the same sex have 0,07 additional children. This estimate is comparable with Angrist and Evans (1998), where women have 0,06

Table 4
First stage results, 1993

VARIABLES	All ages (1)	2 years old or younger (4)	6 years old or younger (3)	Between 6 and 10 (6)	18 years old or younger (2)	Between 11 and 18 (7)
Fitted values of KIDS (Twins 1)	0,601*** (0,011)	0,884*** (0,009)	0,723*** (0,009)	0,598*** (0,017)	0,610*** (0,010)	0,547*** (0,021)
Observations	1 710 171	220 902	592 367	451 716	1 532 564	583 386
Fitted values of KIDS (Twins 2)	0,673*** (0,012)	0,946*** (0,007)	0,794*** (0,010)	0,708*** (0,020)	0,677*** (0,012)	0,646*** (0,025)
Observations	1 335 386	228 238	559 035	382 745	1 264 877	404 463
Fitted values of KIDS (Same-sex)	0,072*** (0,002)	0,009*** (0,001)	0,033*** (0,002)	0,079*** (0,003)	0,069*** (0,002)	0,106*** (0,005)
Observations	1 312 485	224 988	550 536	377 032	1 243 954	396 540

Table 5
First stage results, 2007

VARIABLES	All ages (1)	2 years old or younger (4)	6 years old or younger (3)	Between 6 and 10 (6)	18 years old or younger (2)	Between 11 and 18 (7)
Fitted values of KIDS (Twins 1)	0,623*** (0,008)	0,951*** (0,006)	0,815*** (0,007)	0,611*** (0,013)	0,650*** (0,008)	0,520*** (0,015)
Observations	2 236 263	255 603	672 564	573 537	1 947 972	808 438
Fitted values of KIDS (Twins 2)	0,750*** (0,009)	0,985*** (0,005)	0,900*** (0,007)	0,752*** (0,015)	0,754*** (0,009)	0,688*** (0,019)
Observations	1 579 351	265 808	635 935	431 586	1 483 865	500 366
Fitted values of KIDS (Same-sex)	0,066*** (0,002)	0,005*** (0,001)	0,028*** (0,001)	0,061*** (0,003)	0,062*** (0,002)	0,095*** (0,003)
Observations	1 567 263	263 755	631 017	428 357	1 472 470	496 476

Standard errors in parentheses. *** p<0,01, **p<0,05, *p<0,1. Sample for Twins 1: Women between 15 and 49 years old who have at least one child (no triplets) and consistent data about number of children, whose children are between 0 and 25 years old. Sample for Same-sex: Women between 15 and 49 years old who have at least two children (no triplets or twins) and consistent data about number of children, whose children are between 0 and 25 years old.

additional children. Unlike what occurred with twins, this instrument works better for older children. When second child is 2 years old or younger, mothers are not very willing to increase their families. This holds even if they are looking for a child of another gender. Mothers with the first two children of the same sex and whose second child is between 11 and 18 years old have 0,11 additional children.

Estimates of the causal effect of fertility on labor market outcomes are shown in Tables 6 and 7. For each year, we report the aggregate results for the whole sample and disaggregated results by age of the first or second child. These results are shown for both the whole sample of women and the married women subsample. Using data for 1993, having a second child reduces the probability of working in general, but the effect is almost three times as large among mothers with a child 2 years old or younger. These estimates are smaller than the ones with the simple OLS estimation, which confirms that endogeneity in the variable KIDS leads to overestimation of the relationship between children and work. Estimates for married women follow the same pattern, though they are smaller in magnitude. This is somewhat puzzling as theory would suggest that a marriage contract provides a better framework for household resource pooling and thus allows more flexibility for women to pull out of the labor market.

Using "twins-second" as an instrument, we find a statistically significant negative effect of having a third child on labor supply only for the subsamples of mothers with a second child younger than 2 and 6 years old. The full sample shows no significant effect and neither do the samples of mothers with an older second child. Thus we cannot reject that the overall effect of having a third child on women´s work is zero. However, there is substantial heterogeneity across the reference child's age. The magnitude of the significant coefficients is smaller than those for twins in the first birth. The effect of a third child can also be seen using the "same-sex" instrument. Within this subsample, significant effects are only observed for married women. They are of the expected sign and comparable magnitude to Twins 1. As expected, significant effects come later as mothers wait before having a third child.

Results for 2007 are similar to those found for 1993, but the magnitudes are substantially larger. In this case, reductions in employment are also significant for the birth of a third child using the "twins-second" strategy. Also, in contrast to the 1993 estimates with "same-sex" strategy, 2007 estimates are significant for the whole sample. Having a third child has a statistically significant negative effect on labor supply for all women. The pattern of significant effects arising at later ages of the second child persists.

Contrasting results for the two years are informative about the nature of the relationship between fertility and women's work. In effect, although the direction and significance of the effect is stable, the size may vary. Two factors may be at play: participation rates and economic cycle. Participation was lower in 1993. If lower participation rates reveal more selection into the labor force, those women that select themselves to work may have a stronger attachment to the labor market and thus be less likely to leave employment due to having a child. The economic cycle may also play a role, as greater availability of jobs may make it easier to leave employment temporarily since the likelihood of successfully re-entry in the labor force is greater.

Table 6

Effects of fertility on the probability of working, 1993

VARIABLES	All ages (1)	2 years old or younger (4)	6 years old or younger (3)	Between 6 and 10 (6)	18 years old or younger (2)	Between 11 and 18 (7)
Fitted values of KIDS (Twins 1)	-0,020***	-0,054***	-0,025***	-0,007	-0,019***	-0,021*
	(0,006)	(0,012)	(0,009)	(0,013)	(0,007)	(0,012)
Observations	1 710 171	220 902	592 367	451 716	1 532 564	583 386
Fitted values of KIDS (Twins 2)	-0,004	-0,034***	-0,015*	-0,001	-0,004	0,002
	(0,006)	(0,011)	(0,008)	(0,012)	(0,007)	(0,012)
Observations	1 335 386	228 238	559 035	382 745	1 264 877	404 463
Fitted values of KIDS (Same-sex)	-0,005	0,280	0,007	-0,012	-0,003	-0,009
	(0,010)	(0,196)	(0,034)	(0,018)	(0,011)	(0,013)
Observations	1 312 485	224 988	550 536	377 032	1 243 954	396 540

Table 7
Effects of fertility on the probability of working for married women, 1993

VARIABLES	All ages (1)	2 years old or younger (4)	6 years old or younger (3)	Between 6 and 10 (6)	18 years old or younger (2)	Between 11 and 18 (7)
Fitted values of KIDS (Twins 1)	-0,015* (0,009)	-0,046*** (0,017)	-0,012 (0,012)	-0,003 (0,018)	-0,015 (0,009)	-0,019 (0,015)
Observations	1 057 916	98 978	300 292	273 244	925 078	406 168
Fitted values of KIDS (Twins 2)	-0,000 (0,008)	-0,038*** (0,015)	-0,013 (0,011)	0,006 (0,015)	0,000 (0,008)	0,003 (0,014)
Observations	874 062	119 056	317 518	252 768	818 079	299 043
Fitted values of KIDS (Same-sex)	-0,018* (0,011)	0,192 (0,230)	-0,035 (0,038)	-0,020 (0,019)	-0,019* (0,011)	-0,020 (0,013)
Observations	859 058	117 292	312 686	249 067	804 597	293 359

Standard errors in parentheses. *** p<0,01, **p<0,05, *p<0,1. Sample for Twins 1: Women between 15 and 49 years old who have at least one child (no triplets) and consistent data about number of children, whose children are between 0 and 25 years old. Sample for Same-sex: Women between 15 and 49 years old who have at least two children (no triplets or twins) and consistent data about number of children, whose children are between 0 and 25 years old.

How important is fertility in women's increasing employment? We can use our estimates to gauge such importance. As shown above, the effect of a second child reduces women´s probability of working between 2,0 and 3,3 percentage points. Taking an average of the effect in both years and following Jacobsen et al. (1999), we can estimate the contribution of fertility to the overall increase in women's employment. During the time between censuses, the number of children per mother decreased by 0,36 decimal points. Thus, the decline in fertility rates was responsible for an increase of 0,97 (=(-0,027)*(-0,36)) percentage points in women´s employment. Since according to census data, women´s employment increased by 3,6 percent points during those two decades, 27 percent of that increment can be attributed to the decline in fertility. The magnitude of the contribution of declining fertility is considerable since other relevant changes have occurred during the last decade—for instance, an increase in women's educational attainment. The effect turns out to be more than four times bigger than the one estimated by Jacobsen et al. (1999) for the United States, who find that 6 percent of the increment in women´s labor force participation is attributed to a decline in fertility.

Table 8

Effects of fertility on the probability of working, 2007

VARIABLES	All ages (1)	2 years old or younger (4)	6 years old or younger (3)	Between 6 and 10 (6)	18 years old or younger (2)	Between 11 and 18 (7)
Fitted values of KIDS (Twins 1)	-0,033*** (0,006)	-0,068*** (0,009)	-0,052*** (0,007)	-0,021* (0,012)	-0,032*** (0,006)	-0,018 (0,012)
Observations	2 236 263	255 603	672 564	573 537	1 947 972	808 438
Fitted values of KIDS (Twins 2)	-0,024*** (0,005)	-0,069*** (0,009)	-0,037*** (0,007)	-0,008 (0,011)	-0,023*** (0,006)	-0,013 (0,011)
Observations	1 579 351	265 808	635 935	431 586	1 483 865	500 366
Fitted values of KIDS (Same-sex)	-0,030*** (0,011)	0,569* (0,319)	-0,038 (0,038)	-0,056** (0,022)	-0,026** (0,012)	-0,011 (0,014)
Observations	1 567 263	263 755	631 017	428 357	1 472 470	496 476

Table 9
Effects of fertility on the probability of working for married women, 2007

VARIABLES	All ages (1)	2 years old or younger (4)	6 years old or younger (3)	Between 6 and 10 (6)	18 years old or younger (2)	Between 11 and 18 (7)
Fitted values of KIDS (Twins 1)	-0,025*** (0,010)	-0,058*** (0,017)	-0,046*** (0,013)	-0,030 (0,020)	-0,026*** (0,010)	-0,016 (0,019)
Observations	931 572	61 231	186 613	212 486	760 685	396 576
Fitted values of KIDS (Twins 2)	-0,018** (0,008)	-0,073*** (0,016)	-0,045*** (0,011)	-0,010 (0,015)	0,018** (0,009)	0,004 (0,015)
Observations	740 756	87 677	237 588	202 173	679 417	276 664
Fitted values of KIDS (Same-sex)	-0,027** (0,013)	0,461 (0,427)	-0,052 (0,059)	-0,053* (0,028)	-0,024 (0,015)	-0,007 (0,017)
Observations	735 032	86 931	235 655	200 618	674 097	274 540

Standard errors in parentheses. *** p<0,01, **p<0,05, *p<0,1. Sample for Twins 1: Women between 15 and 49 years old who have at least one child (no triplets) and consistent data about number of children, whose children are between 0 and 25 years old. Sample for Same-sex: Women between 15 and 49 years old who have at least two children (no triplets or twins) and consistent data about number of children, whose children are between 0 and 25 years old.

Do fertility effects vary with mothers' education?

We now test whether effects vary across educational groups. From a human capital perspective, higher levels of education are associated with better-paid jobs. Thus, women who have accumulated more human capital face higher opportunity costs of unemployment. Under this rationale we would expect smaller fertility effects as women reach higher levels of education, since renouncing employment is more costly for them (Becker 1965). On the other hand, women with higher educational levels may be more likely to marry highly educated males and thus be part of financially more stable households. A number of studies have analyzed women's labor market decisions in the context of the collective labor supply of the household (Chiappori 1992). The question hinges on the size of substitution versus income effects. Empirically we do not have conclusive evidence.

We produce estimates for the three instruments considering five categories of education level: no education or incomplete primary education, complete primary or incomplete secondary, complete secondary, (complete or incomplete) non-university tertiary, and (complete

Table 10
Impact of fertility on work by mother's education, 1993

VARIABLES	All education levels (1)	No education or incomplete primary (2)	Complete primary of incomplete secondary education (3)	Complete secondary education (4)	Non-universitary education (5)	Universitary education (6)
Fitted values of KIDS (Twins 1)	-0,020*** (0,006)	-0,020* (0,011)	0,009 (0,012)	-0,047*** (0,014)	0,007 (0,021)	-0,072*** (0,025)
Observations	1 710 171	496 031	395 600	306 345	172 527	154 429
Fitted values of KIDS (Twins 2)	-0,004 (0,006)	-0,013 (0,011)	-0,016 (0,013)	-0,005 (0,014)	0,008 (0,020)	-0,003 (0,022)
Observations	1 335 386	421 366	308 316	225 875	113 626	106 842
Fitted values of KIDS (Same-sex)	-0,005 (0,010)	-0,031 (0,021)	-0,001 (0,020)	0,018 (0,018)	0,001 (0,030)	0,001 (0,031)
Observations	1 312 485	415 011	303 347	221 536	111 177	104 485

Table 11
Impact of fertility on the probability of working, 2007

VARIABLES	All education levels (1)	No education or incomplete primary (2)	Complete primary of incomplete secondary education (3)	Complete secondary education (4)	Non-university education (5)	Universitary education (6)
Fitted values of KIDS (Twins 1)	-0,033***	-0,020*	-0,015	-0,053***	-0,023	-0,046***
	(0,006)	(0,011)	(0,012)	(0,012)	(0,014)	(0,014)
Observations	2 236 263	493 377	566 934	485 063	385 532	305 357
Fitted values of KIDS (Twins 2)	-0,024***	-0,021*	-0,025**	-0,007	-0,019	-0,033**
	(0,005)	(0,011)	(0,011)	(0,012)	(0,014)	(0,015)
Observations	1 579 351	403 596	414 871	318 841	246 887	195 156
Fitted values of KIDS (Same-sex)	-0,030***	-0,029	-0,017	-0,028	-0,076***	-0,005
	(0,011)	(0,020)	(0,020)	(0,023)	(0,028)	(0,033)
Observations	1 567 263	400 724	411 877	316 386	244 861	193 415

Standard errors in parentheses. *** p<0,01, **p<0,05, *p<0,1. Sample for Twins 1: Women between 15 and 49 years old who have at least one child (no triplets) and consistent data about number of children, whose children are between 0 and 25 years old. Sample for Same-sex: Women between 15 and 49 years old who have at least two children (no triplets or twins) and consistent data about number of children, whose children are between 0 and 25 years old.

or incomplete) university[5]. Results for 1993 show significant effects of a second child for women with up to incomplete primary, complete secondary, or university education. Effects tend to be stronger when women have more education: the effect on women with university education is more than three times as large as that for women with incomplete primary or no education. Results for 2007 are qualitatively similar for the second child. For the third child, significant effects using twins suggest the same pattern, with stronger effects for women with university education. Thus, our data support the hypothesis of a much stronger "socioeconomic level" than a "human capital" effect of fertility.

5 Estimates for more disaggregate categories (no education, incomplete primary, complete primary, incomplete secondary, complete secondary, incomplete non-university tertiary, complete non-university tertiary, incomplete university, and complete university) are available from the researcher upon request.

4. CONCLUSIONS

We estimate the causal effect of fertility on women's employment using instrumental variables at two points along Peru's demographic transition path and analyze the heterogeneity of the effects along three lines: marriage status of the mother, age of the youngest child, and mother's level of education. We have five key findings. First, we confirm the prevalent finding in the literature that fertility has a negative causal effect on women's employment. Effects are larger for the second than for the third child. When we average the effects of the second child in the two years considered, we conclude that 27 percent of the total increase in women's employment can be attributed to declining fertility. This is a considerable magnitude, more than four times as large as the estimate for the US by Jacobsen et al. (1999). This means that the declining trend of fertility rates in Peru during the last two decades has contributed to an increase of 0,97 percent points in women's rate of employment.

Second, effects are larger the younger the first child is (or the second one, in the case of 'Same-sex'). For instance, effects are more than twice as large when the first (second) child is not older than 2 years. They decline as the first (second) child is older. Third, fertility effects may vary over time but tend to be greater as women's rate of participation increases. Thence, effects are more than 50% greater in 2007, when employment rates were about 5 points higher than in 1993.

Fourth, effects also vary with the level of education of the mother, tending to be stronger when women have more education: for 1993 the effect on women with university education is more than three times as large as that for women with incomplete or no education. Results for 2007 are qualitatively similar. Finally, effects are systematically smaller for married women than for all women. This result leaves an interesting question open for future research: why would married women be less likely to alter their labor market behavior after bearing a child than unmarried women?

Our findings are broadly in line with previous studies, including the effects of a second child as presented by Jacobsen et al. (1999) for the United States and the effect of a third child as presented by Angrist and Evans (1998) for the United States and Cruces and Galiani (2007) for Argentina and Mexico. However, there are interesting contrasts as well. In terms of the effects of a second child, estimates based on the twins instrumental variable (IV) are larger for Peru for all ages of the first child (up to 18 years old). At the same time, the distribution of the effects by the age of the first child varies: effects in the US data are more than twice as large when the first child is under 2 years old, but disappear thereafter, while in Peru effects are significant until the first child is 6 years old in the 1993 data and 10 years old in 2007. Finally, effects of the third child, identified through the 'Twins2' or 'Same-sex' IVs, are smaller for Peru.

REFERENCES

Agüero, Jorge and Mindy Marks (2008). Motherhood and female labor force participation: evidence from infertility shocks. *American Economic Review Papers and Proceedings, 98*(2):500–504.

Angrist, Joshua and William Evans (1998). Children and their parents' labor supply: evidence from exogenous variation in family size. *American Economic Review, 88*(3):450–77.

Becker, Gary S. (1965). A theory of the allocation of time. *The Economic Journal, 75*(299): 493–517.

Becker, Gary S. (1973). A theory of marriage: Part I. *Journal of Political Economy, 81*(4): 813–846.

Bloom, David and David Canning. (2004). *Global demographic change: dimensions and economic significance.* NBER Working Paper, 10817. Cambridge, MA: NBER.

Bloom, David and Jeffrey Williamson (1998). Demographic transitions and economic miracles in emerging Asia. *World Bank Economic Review, 12*(3): 4 19-455.

Bloom, David; David Canning and Jaypee Sevilla (2003). *The demographic dividend: a new perspective on the economic consequences of population change*. Santa Monica, CA: RAND Corporation.

Bloom, David; David Canning, Günther Fink and Jocelyn E. Finlay (2007). *Fertility, female labor force participation, and the demographic dividend*. NBER Working Paper, 13583. Cambridge, MA: NBER.

Bourguignon, François and Maria Concetta Chiuri (2005). *Labor market time and home production: a new test for collective models of intra- household allocation*. Economics CSEF Working Paper, 131. Fisciano (SA): Centre for Studies in Economics and Finance.

Bronars, Stephen and Jeff Grogger (1994). The economic consequences of unwed motherhood: using twin births as a natural experiment. *The American Economic Review, 80*(5):1141-56.

Cáceres-Delpiano, Julio (2008). *Keeping the best for last. impact of fertility on mother's employment: evidence from developing countries*. Economics Working Papers, 08-68. Madrid: Universidad Carlos III, Departamento de Economía.

CEPAL (2008). *Transformaciones demográficas y su influencia en el desarrollo en América Latina y el Caribe*. Santiago: Comisión Económica para América Latina y el Caribe.

Chiappori, Pierre-André (1992). Collective labor supply and welfare. *Journal of Political Economy, 100*(3), 437-467.

Chiappori, Pierre-André; Bernard Fortin and Guy Lacroix (2002). Household labor supply, sharing rule and the marriage market. *Journal of Political Economy, 110*(1), 37-72.

Choné, Philippe; David le Blanc and Isabelle Robert-Bobée (2003). *Female labor supply and child care in France*. Paris: CREST-INSEE.

Contreras, Dante; Esteban Puentes and David Bravo (2012). *Female labor supply and child are supply in Chile*. Serie Documentos de Trabajo, 370. Santiago: Universidad de Chile. Departamento de Economía.

Cristia, Julian. (2008). The effect of a first child on female labor supply: evidence from women seeking fertility services. *Journal of Human Resources, 43*(3), 487-510.

Cruces, Guillermo and Sebastian Galiani (2007). Fertility and female labor supply in Latin America: new causal evidence. *Labour Economics, 14*(3), 565-573.

Gong, Xiaodong; Robert Breunig and Anthony King (2010). New estimates of the relationship between female labour supply and the cost, availability, and quality of child care. *Economic Roundup*, (1), 51-62.

Hahn, Chin Hee and Chang-Gyun Park (2010). Demographic transition, human capital accumulation and economic growth: some evidence from cross-country and Korean microdata. In Takatoshi Ito and Andrew Rose (Eds.). *The economic consequences of demographic change in East Asia* (p. 93-124). NBER-EASE, Volume 19. Chicago: University of Chicago Press; NBER.

Heckman, James (1974). Shadow prices, market wages, and labor supply. *Econometrica, 42*(4), 679–94.

Higgins Matthew and Jeffrey Williamson (1997). Age structure dynamics in Asia and dependence on foreign capital. *Population and Development Review, 23*(2), 261-93.

Hotz, V. Joseph and Robert A. Miller (1988). An empirical analysis of life cycle fertility and female labor supply. *Econometrica, 56*(1), 91-118.

Jacobsen, Joyce; James Wishart Pearce III and Joshua Rosenbloom (1999). The effects of childbearing on married women's labor supply and earnings: using twin births as a natural experiment. *The Journal of Human Resources, 34*(3), 449-474.

Lindh Thomas and Bo Malmberg (1999). *Age structure effects and growth in the OECD, 1950-1990. Journal of Population Economics, 12*(3), 431-449.

Mittler, Peter (1971). *The study of twins*. Harmondsworth: Penguin.

Rosenzweig, Mark and Kenneth Wolpin (1980a). Life cycle labor supply and fertility: causal inferences from household models. *Journal of Political Economy, 88*(2), 328-48.

Rosenzweig, Mark and Kenneth Wolpin (1980b). Testing the quantity-quality fertility model. *Econometrica, 48*(1), 227-240.

Rosenzweig, Mark (1990). Population growth and human capital investments: theory and evidence. *Journal of Political Economy, 98*(5), S38-70.

Rosenzweig, Mark and Paul Schultz (1985). The demand for and supply of births: fertility and its life cycle consequences. *The American Economic Review, 75*(5), 992-1015.

Schultz, T. Paul (2007). *Fertility in developing countries*. Center Discussion Paper, 953. New Haven, CT: Economic Growth Center. Yale University.

Williamson, Jeffrey G. (2001). Demographic change, economic growth, and inequality. In Nancy Birdsall, Allen C. Kelley and Steven Sinding (Eds.). *Population matters: demographic change, economic growth, and poverty in the developing world* (pp. 106-136). Oxford: Oxford University Press.

Williamson, Nancy E. (1976). *Sons or daughters: a cross-cultural survey of parental preferences*. Beverly Hills, CA: Sage Publications.

Wooldridge, Jeffrey (2002). *Econometric analysis of cross section and panel data*. Cambridge: The MIT Press.

APPENDIX 1
SUMMARY STATISTICS

Table A.1
Sample of "twins-first" strategy

Variable	**Census 1993** **1 710 171 obs**	**Census 2007** **2 236 263 obs**
Urban residence	0,742	0,778
	(0,437)	(0,415)
Children currently alive	2771	2283
	(1,562)	(1,242)
Age of oldest child	9936	10 624
	(6,198)	(6,322)
Age of second child	8522	8756
	(5,643)	(5,747)
Age of third child	7465	7518
	(5,090)	(5,110)
Had twins in first birth	0,008	0,007
	(0,086)	(0,085)
Had twins in second birth	0,006	0,005
	(0,076)	(0,073)
Same sex children	0,393	0,355
	(0,488)	(0,478)
Age	31 979	33 059
	(7,274)	(7,540)
Age at first birth	22 043	22 435
	(4,507)	(4,846)
Years of education	4216	4708
	(2,171)	(2,306)
Employed EAP	0,270	0,330
	(0,444)	(0,470)

Sample: Women between 15 and 49 years old who have at least one child (no triplets) and consistent data about number of children, whose children are between 0 and 25 years old.

Table A.2
Sample of "twins-second" strategy

Variable	Census 1993 1 335 386 obs	Census 2007 1 579 351 obs
Urban residence	0,731	0,764
	(0,443)	(0,424)
Children currently alive	3268	2817
	(1,414)	(1,103)
Age of oldest child	11 482	12 680
	(5,635)	(5,560)
Age of second child	8522	8756
	(5,643)	(5,747)
Age of third child	7465	7518
	(5,090)	(5,110)
Had twins in first birth	0,010	0,010
	(0,098)	(0,101)
Had twins in second birth	0,008	0,008
	(0,086)	(0,087)
Same sex children	0,503	0,503
	(0,499)	(0,499)
Age	33 119	34 625
	(6,810)	(6,844)
Age at first birth	21 636	21 945
	(4,170)	(4,418)
Years of education	4045	4500
	(2,134)	(2,314)
Employed EAP	0,256	0,318
	(0,436)	(0,465)

Sample: Women between 15 and 49 years old who have at least two children (no triplets) and consistent data about number of children, whose children are between 0 and 25 years old.

Table A.3
Sample of "same-sex" strategy

Variable	Census 1993 1 312 485 obs	Census 2007 1 567 263 obs
Urban residence	0,730	0,764
	(0,444)	(0,424)
Children currently alive	3262	2812
	(1,412)	(1,102)
Age of oldest child	11 490	12 677
	(5,626)	(5,560)
Age of second child	8503	8756
	(5,633)	(5,748)
Age of third child	7433	7498
	(5,073)	(5,098)
Had twins in first birth	0,000	0,010
	(0,000)	(0,100)
Had twins in second birth	0,000	0,000
	(0,000)	(0,000)
Same sex children	0,502	0,503
	(0,499)	(0,499)
Age	33 105	34 616
	(6,804)	(6,845)
Age at firts birth	21 615	21 939
	(4,157)	(4,415)
Years of education	4039	4499
	(2,131)	(2,314)
Employed EAP	0,256	0,318
	(0,436)	(0,465)

Sample: Women between 15 and 49 years old who have at least two children (no triplets or twins) and consistent data about number of children, whose children are between 0 and 25 years old.

EFFECTS OF FERTILITY ON WOMEN'S
WORKING STATUS
se terminó de editar en el
mes de abril del 2016.