THE IMPACT OF MULTIPLE BIRTHS ON WOMEN'S HOURS OF WORK AND WAGES

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Abstract

While a number of studies have found a negative relationship between female labor force participation and fertility, the effect of this latter variable on hours of works and wages is less clear. Most reported effects on women's hours of work establish a negative relationship or no effect at all. Also there is some evidence of a reduction in woman's probability of working full-time in the presence of young children, while the probability of working part-time is increased. The fall in mothers' hours of work is attributed to the increased value of women's home time after having a child. This paper considers the impact of children on wages and hours of work using a sample of Chilean mothers. Unlike previous research in the country instrumental variables are included to control for potential endogeneity and heterogeneity biases. In a model that considers women's selection into part-time work, full-time work or non-employment I observe a motherhood wage premium for those women that have a second child. As most previous research has found a wage penalty or not penalty at all for having children, this result is surprising. I hypothesize that mothers of large families may put more effort to improve their labor positions or, alternatively, that employers may assign a higher value to what they believe are more committed workers. However, no measured premium for those women having more than two children, suggests the effect is not increasing in number of children.

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I. Introduction

For developed countries a large literature exists on how children affect their mothers' hours of work and wages[1]. Most of it states that particularly young children negatively influence wages and supplied hours to the labor market. Less empirical evidence is available for developing countries. Studies for Latin-American countries support the general finding of children negatively affecting women's labor supply. Behrman and Wolfe (1984) conclude that in Nicaragua the negative impact of small children on women's earnings is much less important than in more developed economies. For Guatemala, Hallman et al. (2003) shows that after selection into the labor market is considered the presence of children ages 3 to 7 years old is a significant determinant of wages. Using a structural labor supply model for Mexican data, Gong and Van Soest (2000) state that young children diminish wife's hours of work.

For Chile, as part of the results from the estimation of labor supply equations, some researches suggest links between fertility and labor variables. It has been reported that the number of preschool children reduces women's hours of work (Muchnik et al., 1991; Mizala et al., 1998). Mizala et al. (1999) show that, not only preschool children but all children under 15 years old inhibit female labor supply.

All three studies consider a two equations model. Muchnik et al. (1991) first estimate a wage equation for working women, and then they estimate hours of work using a Tobit regression for all women, including as explanatory variables the predicted wage and the number of children in two age ranges (preschoolers and 6 to 13 years old). Selection bias in the wage equation is probably affecting the estimates they get, and thus also biasing the estimates from the labor supply equation. Very low rates of participation for women in Chile make this a special concern. Mizala et al. (1998) and Mizala et al. (1999) first estimate hours of work with a Tobit model that includes those individuals not working. The second step consists in a wage equation that corrects selection through a fictitious variable generated from the Tobit model.

[1] For the US, Waldfogel (1997), Cappelli et al. (1998), Budig and England (2001), Anderson et al. (2002), Hersch (1991), Chiappori et al. (2002), Angrist and Evans (1998), Blank (1988), Averett and Hotchkiss (1997). For Great Britain, Layard et al. (1980), Greenhalgh (1980), Dolton and Makepeace (1987), Joshi et al. (1999). For the Netherlands, Simonsen and Skipper (2003), Datta Gupta and Smith (2002). Breusch and Gray (2004) for Australia and Drolet (2002) for Canada.

Contreras et al. (2005) observe a positive impact of children under six years old on women's labor force participation. Older children have a negative impact on labor supply. However, restricting the sample to women older than 26 years old, small children negatively affect labor supply. These authors also assume family composition to be exogenous.

These four studies assume family composition to be exogenous to labor supply decisions, with a risk of getting biased estimates of the parameters associated to children. None of the studies differentiated between part-time and full-time work decisions either. Although women working part-time represent a small percentage of those working (around 36% in Chile), it is reasonable to expect differences in their characteristics and motivations to work.

Differences in participation rates, time at work and wages by motherhood status have a number of theoretical explanations. Differences in characteristics between mothers and non-mothers could affect these variables. Studies generally control for observable characteristics, particularly work experience and education. Mothers have more intermittent participation than childless women, affecting work experience and thus expected wages and future participation decisions (Nakamura and Nakamura, 1992; Altug and Miller, 1998, Belzil and Hergel, 1999; Francesconi, 2002). Also, anticipating lower participation, mothers may invest less in education and training reinforcing the negative effect on expected wages.

While there are some suggestions that the fertility effect on wages operates through the reduction in the accumulation of human capital through experience (Hill, 1979; Bradler and Wong, 1996; Datta Gupta and Smith, 2002), there is also evidence that even after controlling for labor market experience, the effect of children on women's wages persists (Waldfogel, 1997; Budig and England, 2001).

Controlling for unobserved heterogeneity between mothers and non-mothers is more difficult. If women of lower ability and/or lower career ambition are also those with stronger preferences for children, and no control for these unobservables is considered, then a spurious negative impact of fertility on labor supply will be reported. Francesconi (2002) shows a clear relationship between earnings ability and preference for children among US women. A previous study by Cappelli et al. (1998) states no significance of variables measuring work priorities in explaining wages, but they would however help explain earnings, suggesting that they may influence hours of work. For Britain, Swaffield (2000) finds that motivation towards

the labor market rather than the home has a positive and significant effect on women's wages. Results when controlling for heterogeneity are mixed but, in general, the negative effects of children on women's labor supply and wages fall.[2] The larger effect is associated to preschool children.

Another source of bias in the estimated coefficients may be given by the simultaneity of women's fertility and labor supply decisions.[3] Some researchers have tested the endogeneity of fertility and female labor supply decisions. While some have rejected the exogeneity of children (Jakubson, 1988), others have not (Mroz, 1987; Korenman and Neumark, 1992; Neumark and Koreman, 1994). Amuedo-Dorantes and Kimmel (2004) cannot reject the endogeneity of motherhood and wages. If having lower wages lead to having more children (Heckman and Walker, 1990; Felmlee, 1993) the impact of children would be biased upward. Actually, causation appears to go in both directions (Kalwij, 2000; Budig, 2003). According to Cramer (1980) the dominant effects are from fertility to employment in the short run and from employment to fertility in the long run.

When analyzing the motherhood wage gap, selection into the labor market should be considered. The absence of a wage penalty for working mothers could be hiding the fact that non-working mothers are the ones who would face the largest penalty if they were to work. Thus wage equations for women must control for possible systematic differences between women who participate in the labor force and those who do not. Otherwise the coefficients may be biased. Dolton and Makepeace (1986), for example, show that the negative impact of children on women's wages found when using OLS disappears after controlling for labor force participation. Amuedo-Dorantes and Kimmel (2004) report that correcting for selection into the labor force, the motherhood wage gap drops approximately to its half.

Becker (1985) proposes another reason for the existence of a motherhood gap. He argues that the effort mothers put on housework and childcare negatively affect their productivity at work. Bittman et al. (2001), using Australian data, find

[2] Waldfogel (1995, 1997), Lundberg and Rose (2000), Iacovou (2001), Datta Gupta and Smith (2002), Anderson et al. (2003), Avellar and Smock (2003), Winter (2004).

[3] According to Wetzels and Zorlu (2003) the motherhood decision is significantly correlated with the employment decision. Hersch (1991) observes a negative impact of wages on housework, and of housework on wages.

that children increase unpaid work, and more so younger ones.[4] However, according to Anderson et al. (2003), the unexplained wage penalty among American mothers is not wholly consistent with a work-effort argument.

With the same reasoning, mothers would be more prone to accept lower wages for mother-friendly jobs. For the US, mother-friendly characteristics of jobs held by mothers explain little of the penalty beyond the tendency of more mothers to work part-time (Budig and England, 2001). In the UK and the Netherlands, the presence of children constrains women choices, who tend to adjust their working time by choosing part-time jobs (Hu and Tijdens, 2003).

Discrimination by employers is an alternative explanation of differences between mothers and non-mothers labor supply. It may affect actual and expected wages and thus inhibit participation directly or through its effects on education and experience accumulation.

This paper considers the impact of children on wages and hours of work using a sample of Chilean mothers. Instrumental variables are included to control for potential endogeneity and heterogeneity biases. The hypothesis is that children have negative effects on hours of work and wages of their mothers, which magnitudes are reduced after controlling for the endogeneity and heterogeneity of fertility. Also smaller effects than those observed in developed countries are anticipated.

The study is organized as follows. Section II gives a brief description on Chilean women and the labor market, and presents the data. Then the methodology and a test of the proposed instruments is done in section III. The forth section summarized main results to finally conclude.

[4] But children of all ages increase women's overall unpaid work time much more than they increase men's.

II. Data Description

Over the last decade women in Chile have experienced a slight increase in their labor market participation. According to data from the National Institute of Statistics (INE, *National Employment Survey*), between 1990 and 2000 women's labor force participation rate has increased from almost 32% to 35%[5]. Women's participation rates in the US and other industrialized countries are higher, with values around 60% and only small increases in the nineties.

Unlike what happens in developed countries, the highest female participation rate is observed for women in their reproductive age (25 to 39 years old), even though this period should be the one with strongest constraints in terms of household responsibilities. The increase in labor force participation over the period is especially large for this group, suggesting that women are developing ways to manage home and labor responsibilities (Caro et al, 2004).

According to the *National Employment Survey* (ENE), 40% of the working women work in full time jobs[6]. Women concentrate their activity in shorter schedules, especially under 35 hours per week, and over the years they have been reducing (on average) their labor supply in terms of hours. In terms of wages, the *1999 Labor Survey* from the Ministry of Labor finds that the percentage of working women in the lowest level of wages is higher than the corresponding percentage for men (Espinosa and Damianovic, 2000).

Data for the study comes from the *National Survey of Socioeconomic Characterization* (CASEN). This cross sectional survey has been conducted almost every two years since 1987 by the Ministry of Cooperation and Planning (MIDEPLAN). It gives information on the socioeconomic conditions of households (and individuals), their incomes, access to social programs, as well as their demographic characteristics. The survey is representative at the regional level, as well as at the county level for a significant number of counties. Seven rounds of this survey are considered, from 1990 to 2003. Surveys are pooled to gain some precision when estimating twin birth's effects.

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[5] The *National Employment Survey* classifies as inactive all those individuals who declare not being working the week preceding the survey, not looking for a job during two months before the survey, and declaring themselves as students, receiving a pension or being dedicated to housework.

[6] 48 hours per week

Using a sample of women ages 24 to 36 from CASEN, some interesting features can be noted. First, women with children under 6 years old have lower labor force participation than childless women or women with older children. This suggests that the presence of preschool children affects female decision to enter the labor market. However, regarding the proportion of women in full time employments, mothers seem to be less likely in these jobs, regardless of the age of children, and less so as the number of children increases.

In terms of average hours of work per week, there is no difference among women in part-time employment. But, among those in full-time employment childless women work more hours than mothers, and mothers of preschoolers less than those with children over 6 years old. The number of preschool children do not affect hours of work in each category of employment.

Average wages for each category are significantly different. Childless women in both full-time and part-time jobs have a higher hourly wage than mothers. Part of this difference can probably be explained by higher experience (since they do not have maternity leaves) and the larger variety of jobs they can accede since they not face family constraints. Hourly wages increases with the number of preschoolers, probably due to selection into employment: only those with relatively higher wages remain in the labor force as family size increase. This trend in wages is given by married women, since among singles and previously married women wages decrease with the number of children.

Table 1. Descriptive Statistics by motherhood status. Women ages 24 to 36.

	LFP (%)	**Working if in LFP (%)**	**Full-time employment if working (%)**	**Average hours of work per week**		**Average hourly wage**	
				Full-time	**Part-time**	**Full-time**	**Part-time**
Childless	0.4591	0.9448	0.8111	50.5021	19.6582	1208.18	2301.06
With preschoolers	0.3864	0.9037	0.7853	48.7175	19.4642	1064.14	2051.239
1	0.4074	0.9046	0.7907	48.8537	19.5631	1008.059	1865.568
2	0.3197	0.8972	0.7614	48.0312	18.9863	1321.652	2780.946
3	0.2403	0.9262	0.7336	48.3922	19.5857	1529.9	3485.019
With children over 6	0.4679	0.9239	0.7761	49.5759	19.2863	1066.514	1946.473

Source: own construction, from CASEN data

For the analysis I specifically consider women ages 24 to 45 with at least one child[7], whose older child is younger than 6 years old. Only women head of nucleus or partner of the head of the nucleus are included in the sample. A second analysis is done further restricting the sample to those women with at least two children. Since married and unmarried mothers may potential have differences in their response to fertility variations, I also estimate the equations for the subsample of married women[8]. Those who work part-time are not excluded from the sample.

Table 2. Descriptive Statistics

Variable	At least one child		At least two children	
	All	Married	All	Married
Age	29.09	29.15	29.09	29.21
Education	11.47	11.54	11.36	11.47
Living with a partner[a] (%)	78.60	1	90.40	1
Living in urban areas (%)	87.26	87.42	86.29	86.35
Fertility				
Average number of children	1.32	1.37	2.10	2.10
Proportion with more than one child (%)	28.84	33.03	1	1
Proportion with more than two children (%)	2.79	3.32	9.41	9.72
Proportion with four or plus children (%)	0.15	0.19	0.49	0.54
Labor Supply				
Labor force participation (%)	44.45	38.14	33.09	30.54
Working (% of LFP)	90.29	91.25	90.33	91.50
In full-time jobs (% of working)	82.43	81.04	77.75	76.76
Average hours of work per week if working	43.20	42.09	41.01	40.35
Average hours of work per week if full-time work	48.11	47.24	47.20	46.59
Average hours of work per week if part-time work	20.18	20.12	19.38	19.73
Average hourly wage for those working	1,242	1,407	1,647	1,820
Average hourly wage for full-time workers	1,050	1,171	1,281	1,400
Average hourly wage for part-time workers	2,150	2,421	2,936	3,216
Number of Observations	29,804	22,831	8,225	7,322

a: Either married or living in a consensual union.
c: Wages from main occupation for those working, expressed in December 1998 Chilean pesos. Own estimations from reported monthly income and weekly hours of work.
Source: own construction, from CASEN data

[7] I choose 24 as the minimum age, because it is expected that education is finished by this age.

[8] The category *married* includes women married and cohabitating

Most women in the sample have a partner, with a larger number of children associated to a higher likelihood of living with a partner. Years of education are more than eleven years, and average age is 29 years old. An additional child is associated to a reduction in LFP, an increase in hourly wages and a reduction in hours of work.

III. Methodology

To measure the impact of children on women's wages and hours of work, a simple reduced form model is proposed. Two dependent variables are used: weekly hours of work and the natural logarithm of hourly income from the main occupation. Fertility and other controls are included as independent variables. The interest will be in the coefficient associated to the fertility variable.

Initially the model is estimated for the sample of working women. Women working for whom information on the dependent variable is not available are excluded from the analysis.

Some problems may cause bias in the estimated coefficient on the fertility variable. First there is a selection problem. If working women are different from those not working regarding their fertility behavior, excluding this latter group from the analysis may bias the estimated coefficients. Labor supply decisions are partly based on the wage that could be earned, thus the finding of no wage penalty for working mothers could be hiding the fact that the non-working mothers are the ones facing the largest penalty if they were to work. To solve this problem a simultaneous equation model is estimated, where woman's selection into work is considered.

Additional biases can arise from endogeneity and heterogeneity problems. It is reasonable to expect that women's desired hours of work as well as reservation wage are determinants as well as determined by the fertility decision. If fertility is correlated with the error term in the labor supply equation, endogeneity is biasing the estimated coefficients. When higher hours of work negatively affect women's fertility, it is possible to measure a negative impact of fertility on hours, even though it may not exists.

The relationship between labor supply measures and children may also be driven by an unobserved third variable, as woman's orientation to family/work. This generates the heterogeneity bias. Work oriented women most likely prefer longer periods of work and will probably have lower reservation wages. Observing a

decline in women's labor supply or wages if having an extra child could be masking the fact that women whose wages were expected to decrease prefer to have an additional child. Note that heterogeneity and endogeneity biases would probably work in the opposite direction of the selection bias, causing the penalty to be overstated rather than understated.

To avoid the endogeneity and heterogeneity biases instrumental variables (IV) techniques are used. Neumark and Korenman (1994) argue that instrumental variables estimation may be enough to solve both endogeneity and heterogeneity problems. The imposed condition on instruments is no correlation with unobservables covariates as well as with the error term. To obtain consistent estimates of fertility on labor supply the chosen instrument should affect only fertility directly and not labor supply. A general result, when using instrumental variables for analyzing fertility's impact on women´s labor supply and wages, is that OLS exaggerate the causal effect of fertility on labor variables.

A widely used instrument when estimating the effect of family size on different child or woman outcomes is twin births.[9] Twins are considered a natural experiment involving an unanticipated and exogenous change in fertility. If twins are really unanticipated and children cannot be traded, some women with twins experience an exogenous variation in planned fertility. Twins are also random with respect to other characteristics that may be related to labor force participation.

The occurrence of twin births provides a good instrument as long as women are not able to adjust to it to reach their desired fertility level. Gandharan and Rosenbloom (1996) show for U.S. mothers, that the impact of twin births on total number of children diminishes with the years. Restricting the sample to women with only preschool children allow me to avoid possible adjustment to desired fertility through time. Since most of the impact of children on woman's labor supply is expected to come from preschoolers this restrictions should not significantly affect the estimates.

[9] Rosenzweig and Wolpin (1980a, 1980b) use it for U.S. and India, Bronars and Grogger (1994), Gangadharan and Rosenbloom (1996), Angrist and Evans (1998), Jacobsen et al. (1999) and Vere (2005) for US data, Lee (2003) for Korea and Black et al. (2004) for Norway.

The major challenge in using the twins approach arises from the need to identify large enough samples of twin mothers (Gangadharan and Rosenbloom, 1996). Otherwise the precision of the coefficients may be affected. Twinning probabilities in the samples are around 1%.[10]

Most studies using the occurrence of twins as IV for fertility, report correlation between twinning probabilities and some observed characteristics of the mother. In particular, twinning probability seems to increase with parity and age at first birth.[11] To avoid this positive correlation between desired family size and twin births, I restrict the analysis to the first and second parity level. For a sample of at least one (two) child (children) the instrument is *twins at first (second) birth*. To estimate consistent direct effects of twin births on family size and women's labor force participation, age at first birth is included as explanatory variable in the model.[12]

When analyzing US data, Angrist and Evans (1998) and Conley (2004) propose using the sex composition of the first two births in families with at least two children as an instrument for fertility.[13] They argue that parents have preferences for mixed sibling-sex composition: those with same-sex children would be more likely to go on to have an additional child.[14] Since the sex of children is essentially random, then it is expected to be uncorrelated with labor supply measures and other covariates. In the same spirit, Chun and Oh (2002) and Lee (2003) use first child's gender as an instrument for fertility. Both have a Korean sample, where households have strong preferences for sons.[15]

A problem of twin births and sex related instruments is that they limit the analysis to samples of women with at least one child. The impact of the first child on the labor market decisions of mothers cannot be assessed. But estimating the marginal effect of an additional child is still useful, since the large majority of

[10] While these numbers are higher than the corresponding samples in Rosenzweig and Wolpin (1980a, 1980b), they are significantly lower than twin samples in latter studies (Bronnars and Grogger, 1994; Gandharan and Rosenbloom, 1996; Angrist and Evans, 1998; Jacobsen et al., 1999; Black et al, 2004; Vere, 2005). Nevertheless, when studying particular subpopulations some of these studies also work with small twin samples.

[11] Bronars and Grogger (1994); Jacobsen et al. (1999).

[12] It should be noted that the birth of twins changes not only family size, but also results in a closer spacing of children, thus affecting a woman's labor supply through mechanisms other than the increase in family size. I do not control for this effect

[13] Iacovou (2001) follows the same IV strategy using British data, Goux and Maurin (2005) do it for France and Cruces and Galiani (2004) for Argentina and Mexico.

[14] Ben-Porath and Welch (1976), Pebley and Westoff (1982) support this view for US families.

[15] Dahl and Moretti (2004) show that US families also have preference for sons.

women do have at least one child. In Chile the current fertility rate is 2.0[16] (United Nations, 2004), meaning that moving to a second and third child are significant decisions for most women.

For a sample of women with at least one child, *twins at first birth* and the *sex of the first child* are analyzed as instruments for the fertility variable *more than one* child. Similarly, for a sample of women with at least two children *twins at second birth* and the *sex composition of the first two children* are considered as instrument for the fertility variable *more than two* children.

Surveys are pooled to gain precision. Also bootstrap methods are used to increase precision when running IV regressions. I assign a twin birth to every woman having two children with the same birth year. The survey does not give more detailed information regarding dates of birth. Possible measurement error from this approximation does not affect the final estimates of the fertility coefficient (Vere, 2005). Sample sizes vary slightly according to the instrument used; see Table 2.

Table 2. Sample Sizes[17]

	Total	**Working**
Twin birth instrument		
At least one child		
All women	29,804	10,171
Women living with a partner	22,831	6,518
At least two children		
All women	8,225	2,035
Women living with a partner	7,322	1,648
Sex related instrument		
At least one child		
All women	29,492	10,079
Women living with a partner	22,592	6,452
At least two children		
All women	8,466	2,104
Women living with a partner	7,498	1,695

Source: own construction, from CASEN data

[16] Period 2000-2005.

[17] Working women for whom no data on hours of work is available are excluded. Slightly more observations are excluded when hourly wage is the dependent variable. The following table summarizes samples sizes in the first case.

Testing the Instruments

Let's now consider how good the proposed instruments are. Women with a single first birth are significantly less likely to have a second child than women with a twin first birth (who have two by construction). Thus, *twin at first birth* seems to be a good instrument. However, it does not seem that parents have a special preference for male (or female) children. Parents with a male first born are equally likely as those with a female first born to go on having a second child. *Sex of the first child* is thus not used as instrument.

Table 3. Women with at least one child: Fraction with *more than one* child

	All women		**Working women**	
	Fraction of sample	**Fraction that had another child**	**Fraction of sample**	**Fraction that had another child**
(1) Single first birth	0.99	0.2802	0.99	0.2086
(2) Twins at first birth	0.01	1	0.01	1
Difference (2)-(1)		**F(1,29803)= 32,006.35**		**F(1,29803)= 16,616.76**
Nº observations	29,804		10,171	
(3) First born female	0.48	0.2776	0.49	0.2028
(4) First born male	0.52	0.2826	0.51	0.2143
Wald test		**F(1,29491)= 0.38**		**F(1,29491)= 0.88**
Nº observations	29,492		10,079	

Calculations use sample weights
Working women for whom no data on hours of work is available are excluded

Again, for the sample of women with at least two children, the *twin birth* instrument seems to be a good option. The sex related instrument might also work when analyzing the complete sample of women: those with same sex children in the first two births are more likely to have a third one. However, when evaluating this instrument only for women working, there is no significant difference in the likelihood of a third child driven by the sex composition of the first two children. This suggests that preferences over sibling sex composition may be related to women orientation towards work: only non working women would prefer a mix sex composition of children over having same sex children. Regressing *more than two children* on the instrument same sex and the other covariates used in the models, it is found that the estimated coefficient on the sibling sex composition instrument is significant only for women not working. Family oriented women, not constrained by

the work/family conflict, are more likely to have additional children in order to have at least one child of each sex than work oriented women.

Table 4. Women with at least two children: Fraction with *more than two* children.

	All women		**Working women**	
	Fraction of sample	**Fraction that had another child**	**Fraction of sample**	**Fraction that had another child**
(1) Single second birth	0.99	0.0866	0.99	0.0680
(2) Twins at second birth	0.01	1	0.01	1
Difference (2)-(1)		**F(1,8224)= 40,906.35**		**F(1,8224)= 15,991.84**
Nº observations	8,225		2,035	
(3) One boy, one girl	0.48	0.0791	0.48	0.0668
(4) Both same sex	0.52	0.0994	0.52	0.0808
Difference (4)-(3)		**F(1,8465)= 5.09**		**F(1,8465)= 0.83**
Nº observations	8,466		2,104	

Calculations use sample weights
Working women for whom no data on hours of work is available are excluded

When running the regressions, other covariates are included. In all cases I control for the age of the mother and its square, years of formal education and its square, age of woman at her first delivery, two dummy variables for marital status, husband's quintile position in the male income distribution and urban/rural residence. Other variables incorporated are age of the second child[18] and year, sex of the first two children,[19] along with regional and cohort dummies.[20]

For the sample of women with at least one child, conditioning on the instrument *twins at first birth* implies a difference for the two fertility variables considered (*number of children* and *more than one child*). As expected, the instrument does not affect the probability of being in the labor force. However, some covariates also seem to depend on the instrument. Particularly, mothers of twins are

[18] Only when analyzing the samples of women with at least two children.
[19] Angrist and Evans (1998) suggest that controls for the sex of the first two children should be included when using the *same sex* instrument. It might be a slight association between the instrument and the sex of each child. This is a concern only if the sex of children affects labor decisions for reasons others than family size.
[20] The year dummies capture the effect of changes in macroeconomic conditions. The omitted year is 1990. Regional dummies capture preference and labor market differences between regions, with the metropolitan area as the excluded region. Cohort dummies capture differences in preferences of women of different generations. The omitted category corresponds to those women born after 1969.

later child bearers and older than non-twin mothers.[21] Note that women with fertility problems are later child bearers, most likely becoming mothers after a fertility treatment. It is widely known that these treatments increase the likelihood of multiple births. When considering only women living with a partner similar conclusions are obtained.

A similar analysis for the sample of women with at least two children shows that the *number of children* and the likelihood of having *more than two children* take different values when conditioning on *twin birth*. For the complete sample of women, covariates that depend on the value the instrument are: age, age at first birth, years of education, urban residence and cohort dummies. Among women with fertility problems, those with more education and in urban areas are more likely to accede to fertility treatments; thus is reasonable to observe a higher level of education and higher likelihood of living in urban areas for twins' mothers. None of the variables related to labor are affected by the instrument.

Corresponding results when using the children's sex composition instrument indicate that fertility variables do depend on sex composition of the first two children for the complete sample of women, while for the restricted sample of working women the instrument is not useful. For the complete sample, mothers with *same sex* children are more educated than mothers with a mix sex composition of the first two children. It is hard to find an explanation to this situation.

Since both *number of children* and *more than 2 children* are affected by the value of the instruments, I choose the second one to be used as the fertility variable. It more accurately represents what is being affected by the instrument: the probability of having a third child. Based on the same reasoning, *more than 1 child* is chosen as the fertility variable when using the sample of women with at least one child.

[21] Different studies have already established that twin probabilities increase with maternal age at birth (Bronars and Grogger, 1994; Jacobsen et al., 1999)

IV. Results

4.1. Working Women

The first analysis is done with the more restricted sample of working women. It should be noted that if working women are different from those not working regarding their fertility behavior, the estimated coefficients will be biased and the conclusions would not be extendible to all women.

When estimating the effect of fertility on women's hours of work, I consider a likelihood function that controls for selection into part-time or full-time employment. The model assumes that, for women that have already decided to work, the first decision regarding hours is to choose between the broad categories of part-time and full-time employment, with further adjustments in hours done after within each category[22]. I hypothesize that the larger effect of children on mother's hours is through her decision to move from full-time to part-time employment.

As shown in Table 5 women having *more than one child* are less likely to choose full-time over part-time employment and on average work fewer hours than women with only one child. Thus, for working women children do impose a constraint in terms of hours of work. Having a second child reduces their likelihood of full-time employment in 3%,[23] while average hours of work decrease in more than half an hour per week if working full-time, and more than an hour and a half if in part-time employment.

IV estimation suggests that having *more than one* child reduces average hours of work only among women in part-time employment. Also the magnitude of the coefficient on the fertility variable increases in all cases. For women having a second child the likelihood of being in a full-time job decreases in 54%,[24] and hours working for those in part-time jobs are reduced in more than four hours per week. For married women the results are similar, with a reduction of 67% in full-time

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[22] The likelihood function being maximized is given by:

$$L(y,\theta) = \prod_{i=1}^{n} [P * f(y,\theta)] \prod_{i=1}^{n} [(1-P) * f(y,\theta)]$$

Where $P = \Phi(\alpha z)$ is the probability that the woman chooses to work full-time. $f(y,\theta)$ describes the density function for hours of work.

[23] Corresponds to the marginal effect of the variable *more than one* on the likelihood of having a full-time employment.

[24] Corresponds to the marginal effect of the variable *more than one* on the likelihood of having a full-time employment.

employment. Probably men share part of the additional household's chores as family size increases.

Thus, not considering the possibility of endogeneity and heterogeneity biases may create a significant underestimation of the impact of children their mother's labor supply. A lower coefficient in the simple regression may be explained by the existence of a positive link from hours of work to fertility: among women working, those working more hours are less financially constrained to support an additional child.

Thus children do impose a time constraint on mothers. Woman working full-time that remains in the labor market after having a second child, are likely to reduce hours of work, even changing to part-time jobs. This is consistent with previous studies for Chile.

Table 5. Working women.
Dependent variable: hours of work per week
Instruments: Twins at 1st and 2nd birth

		Simple regression			**IV estimation**		
		Full time work	**Hours per week**		**Full time work**	**Hours per week**	
			FT	**PT**		**FT**	**PT**
		All women					
More than 1 child	**Estimated coefficient**	-0.1251** (0.0571)	-0.7264* (0.3841)	-1.7487*** (0.6837)	-2.1752*** (0.3365)	-0.9170 (0.9704)	-4.2051** (1.7565)
	Nº Obs	10,171					
More than 2 children	**Estimated coefficient**	-0.0138 (0.1546)	-0.9682 (1.1604)	0.8122 (1.4235)	-0.1251 (0.4347)	2.0737 (2.7637)	-1.9402 (3.5990)
	Nº Obs	2,035					
		Women living with a partner					
More than 1 child	**Estimated coefficient**	-0.1295* (0.0666)	-0.4685 (0.4265)	-1.4065* (0.7711)	-2.5414*** (0.4510)	0.8891 (1.0284)	-4.4831** (2.0732)
	Nº Obs	6,518					
More than 2 children	**Estimated coefficient**	0.0439 (0.1675)	-0.4152 (1.2102)	0.1683 (1.4843)	0.3819 (0.5639)	3.4991 (2.8518)	-4.3295 (4.0247)
	Nº Obs	1,648					

Calculations use sample weights
*** significant at 1%, ** significant at 5%, * significant at 10%

Even though having *more than one* child is associated to a lower likelihood of working in a full-time employment, the same result cannot be establish for having *more than two* children. Within each category of employment having *more than two* children does not impose an additional constraint in terms of hours of work for

working women. This suggests that children do impose a time constraint on working mothers, but the marginal effect of new children is negligible as family size increase. Probably the impact of the first child is the largest.

Regarding wages, a dummy variable is included in the wage regression in order to consider possible differences in wages given by belonging to part-time employment. This assumes that the effect of children on wages is the same for mothers working part-time and full-time. Alternatively, I consider separate regressions for women working full-time and those working part-time to allow for a differential effect of children on these two groups. Estimated coefficients on the fertility variables *more than one child* and *more than two children* for both cases are presented in Table 6.

OLS estimation shows that women having *more than one* child have on average wages 8% higher, however IV estimation does change the results. Estimated coefficients on fertility dramatically increase, but they are estimated with low precision. The motherhood premium can only be supported for women working full-time: having *more than one* child is associated to a 29% higher wage, with an even larger effect for those women living with a partner (37%). Any measured premium for part-timers disappears after IV control, and the magnitude of the corresponding coefficient also falls.[25]

Note that the observed wage premium of having a *more than one* child may be due to a selection effect. An additional child increases the reservation wage of the mother, thus reducing the likelihood to enter (or remain) in the labor market. Thus, women with *more than one* child that keep working are those with higher wages. Women in part-time jobs are less constrained by the arrival of an additional child, thus the hypothesized selection effect should be lower for them. Lower coefficients in simple OLS regressions may be due to the existence of a negative effect from wages to fertility, with higher earnings reducing women's desired number of children. Alternatively, heterogeneity may be driven this situation: it may be that work oriented (and highly paid) women also prefer fewer children.

The null hypothesis cannot be rejected when estimating the impact of having *more than two* children: estimated coefficients are smaller compared to those associated to having *more than one* child, and no statistically different from zero. A

[25] Marginal effects from dummy variables in the semilog equation are calculated considering Halvorsten and Palmquist (1980) suggestion.

selection effect should support a positive coefficient associated to the fertility variable. The results suggest that working women with *more than two* children face a motherhood penalty with respect to those with lesser children that compensates the selection effect. Note that the motherhood wage penalty may be keeping some women out of the labor market; if so the measured penalty underestimates the real one.

Table 6. Working women.
Dependent variable: Ln of hourly wage
Instruments: Twins at 1st and 2nd birth

		Pooled effect		Differential effect			
		OLS	2SLS-IV	Full-Time		Part-Time	
				OLS	2SLS-IV	OLS	2SLS-IV
		All women					
More than 1 child	**Estimated coefficient**	0.0845*** (0.0263)	0.2114 (0.1437)	0.0558** (0.0239)	0.2874* (0.1541)	0.1919** (0.0779)	-0.1805 (0.2323)
	Nº Obs	9,933		8,157		1,776	
More than 2 children	**Estimated coefficient**	-0.0755 (0.0911)	-0.0309 (0.2403)	-0.0443 (0.0936)	0.0081 (0.3390)	-0.0798 (0.2100)	0.0208 (0.2433)
	Nº Obs	1,970		1,546		424	
		Women living with a partner					
More than 1 child	**Estimated coefficient**	0.1246*** (0.0299)	0.3129* (0.1775)	0.0879*** (0.0265)	0.3702* (0.1925)	0.2799*** (0.0881)	0.0864 (0,2537)
	Nº Obs	6,342		5,105		1,237	
More than 2 children	**Estimated coefficient**	-0.0453 (0.0989)	-0.0102 (0.2673)	-0.0161 (0.1009)	0.0145 (0.3627)	-0.0140 (0.2321)	0.0988 (0.2722)
	Nº Obs	1,592		1,234		358	

Calculations use sample weights
*** significant at 1%, ** significant at 5%, * significant at 10%

Note that, in general, IV estimation importantly changes the magnitude of the coefficients on the fertility variable (even if low precision is achieved). Thus, accounting for possible endogeneity and heterogeneity biases, when measuring the effect of children on women's labor decision, is very relevant.

Using the coefficients from the IV estimation it can be said that education has a positive and increasing impact on women's wages. Its impact on the selection of full-time over part-time jobs is also positive, but over 13 years of education each additional year reduces the likelihood of choosing to work full-time. Thus, while more educated women have on average higher wages, they are more prone to choose part-time work if the are in the higher tale of the education distribution.

Later child bearers are women probably with more accumulated experience, which may be explaining the positive coefficient of the variable age at first birth on the wage equations. IV estimation also suggests a negative effect of delaying childbearing on the likelihood of choosing full-time employment.

Women living with a partner and previously married women both have wages significantly larger than those of single women. In terms of hours, living with a partner increases the likelihood of choosing to work full-time over part-time. The observed effects are most probably due to selection into the labor force. Only married women with significantly larger offered wages are willing to leave the household to go to work. Probably, once women are in the labor market man's impact in restricting woman's supply of hours is reduced.

Also partner's relative income has a positive effect on wages: those women whose partners are in higher quintiles of the income distribution earn higher wages. This is probably due to mate selection that implies a high correlation between the earnings of a woman and her partner. Woman whose partner are in the lower quintiles are also less likely to work in full-time jobs.

4.2. Selection model

Estimates from the previous section may not represent the real impact of fertility on woman's labor. A simultaneous maximum likelihood estimation procedure is proposed to consider women's endogenous selection into the working sample. Women choose among three options: (1) not working, (2) part-time work (30 hours of work or less) and (3) full-time work, which is incorporated through a multinomial logit.[26] Separate wage distributions of wages for mothers working part-time and full-time are considered.[27] Some variables determining the reservation

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[26] The excluded category is "not working", which includes women out of the labor force and unemployed.

[27] The likelihood function being maximized is given by:

$$L(y,\theta) = \prod_{i=1}^{F}\left[P_{FT} * f(y,\theta)\right]\prod_{i=1}^{P}\left[P_{PT} * f(y,\theta)\right]\prod_{i=1}^{M}\left[1 - P_{FT} - P_{PT}\right]$$

Where the total number of observations (N) is the sum of women working full-time (F), women working part-time (P) and women not working (M). The probabilities of choosing each of these categories are the following:

$$P_{FT} = \frac{\exp(\beta_{FT} x)}{1 + \exp(\beta_{FT} x) + \exp(\beta_{PT} x)}$$

wage and thus selection are not included in the wage equation. These are age at first birth, age of the second child and dummy variables for woman's marital status and husband's relative labor income.[28]

Among women with at least one child, the coefficient on fertility, without instrumenting this variable, shows that the impact of having *more than one child* partly operates through keeping some women out of the labor market. Having a second child reduces participation in both full-time and part-time jobs. However, when fertility is intrumented using *twin births*, no effect of having *more than one child* on the choice of part-time, full-time or no work is observed. Note also that the magnitude of the coefficients on the fertility variable in the multinomial logit model change after IV estimation. Thus, to get the sole impact of fertility on women's labor supply, instrumenting number of children is an important requirement.

Table 7. Sample of all women
Dependent variable: Ln of hourly wage
Instruments: Twins at 1st and 2nd birth

		Simple estimation				IV estimation. Instrument			
		Full-time	Part-time	Ln hourly wages		Full-time	Part-time	Ln hourly wages	
				Full-time	Part-time			Full-time	Part-time
		All Women				*All Women*			
More than 1 child	**Estimated coefficient**	-0.6701*** (0.0564)	-0.4490*** (0.0969)	0.1077*** (0.0246)	0.2670*** (0.0802)	-0.1827 (0.2858)	-0.5008 (0.4273)	0.2399*** (0.0530)	0.3095** (0.1545)
	Nº Obs	29,566				29,566			
More than 2 children	**Estimated coefficient**	-0.6274*** (0.1853)	-0.5841** (0.2631)	0.0374 (0.1013)	-0.1277 (0.2102)	-0.5503 (0.4176)	-0.0028 (0.6140)	0.2310 (0.2001)	-0.2582 (0.3904)
	Nº Obs	8,160				8,160			
		Women living with a partner				***Women living with a partner***			
More than 1 child	**Estimated coefficient**	-0.6727*** (0.0650)	-0.4575*** (0.1107)	0.0930*** (0.0279)	0.3143*** (0.0899)	0.0176 (0.3324)	-0.4090 (0.5079)	0.0632 (0.0652)	0.2080 (0.1939)
	Nº Obs	22,655				22,655			
More than 2 children	**Estimated coefficient**	-0.5830*** (0.2020)	-0.6309** (0.2846)	0.0301 (0.1075)	-0.0723 (0.2299)	-0.4553 (0.4372)	-0.1273 (0.6767)	0.0460 (0.2250)	-0.4597 (0.4604)
	Nº Obs	7,266				7,266			

Calculations use sample weights
*** significant at 1%, ** significant at 5%, * significant at 10%

$$P_{PT} = \frac{\exp(\beta_{PT} x)}{1 + \exp(\beta_{FT} x) + \exp(\beta_{PT} x)}$$

$$(1 - P_{FT} - P_{PT}) = \frac{1}{1 + \exp(\beta_{FT} x) + \exp(\beta_{PT} x)}$$

[28] Alternative specifications excluding only some of this variables from the wage equation do not change results dramatically

In terms of wages, mothers with *more than one child* seem to benefit from a wage premium. When IV estimation is considered the measured wage premium is even larger, increasing wages in 24% among women in full-time jobs and 31% for those in part-time employment. No wage premium is observed for women living with a partner. Recall from the previous section that for the group of working women a wage premium is observed for women in full-time employment. I argued that the premium in that case may be due to a selection effect, however, these results suggests there is something else explaining the premium. Given these findings, and the high proportion of women not working, it is not possible to ignore the existence of endogenous selection when estimating wages.

In general, IV estimation increases the magnitude of the coefficient on the fertility variable in the wage equation and the significance of the coefficients on full-time and part-time participation disappears. This may be a reflection of lower ability and/or lower career ambition women having stronger preferences for children or, alternatively, that work negatively impacts family size.

The existence of a motherhood wage premium is surprising. Previous researches have found negative or no impact of children on woman's wages. The premium may be due to positive discrimination by employers. If they expect that women with *more than one child* are more committed to work and thus more efficient in their work, they could be paying a premium to those mothers, increasing their motivation and results. It may also be that they expect that women with more children are less likely to have an additional one, and thus the future costs of maternity for the enterprise will be lower, so they will be willing to pay them more. This will be contradicting Becker's hypothesis. Any possible effect of the reduction in the accumulation of experience due to motherhood is more than compensated.

Among women with at least two children, only the simple model shows a significantly negative impact of having a *more than two children* on full-time and part-time work. No impact in employment or wages is measured through IV estimation. Similar results are obtained when using *twins at 2nd birth* and *same sex sibling composition*.

Woman's education and age appear to have a significant effect on women's likelihood of being working. They also increase wages. The presence of a partner reduces the woman's likelihood of being working. Partners are likely to increase the reservation wage of women if there is specialization within the household and

women assume housework. Urban residence increases woman's likelihood of being working, and women in urban areas also earn significantly more (per hour) than those in rural areas. This is probably related to different opportunities in each area.

Thus, after correcting for selection into full-time and part-time work through a multinomial logit model, estimates from the wage equation for women with at least one child suggest the existence of a wage premium for those women having *more than one child*. However, there is no measured motherhood premium for having a *more than two children*. The hypothesis is that employers value the commitment to work of women with two or more children. Having two children instead of one does make a difference in this respect, but a third child does not add a difference.

V. Discussion

Results allow concluding that it is important to consider possible heterogeneity and endogeneity biases. IV estimation significantly changes the magnitude and significance of the estimated coefficients in most of the cases. Links from labor to fertility or unobservable factors influencing both variables may bias the estimates when trying to measure the impact of fertility on labor variables. Results also suggest that it is necessary to control for endogenous selection. Particularly given the low proportion of women working in Chile (around 35%), any estimation of women's wages should consider selection into work.

From the sample of working women it can be concluded that there are two differential effects of an additional child on hours of work. The first is through a reduction in the likelihood of being in full-time over part-time employment and the second by choosing, within part-time employment, shorter schedules of work. Those effects are only observed when women moved to a second child, a third one does not make a difference in terms of hours of work. In the sample of all women there is no observed effect of having *more than one child* or *more than two children* on the likelihood of choosing full-time, part-time or not employment at all.

Assuming the same effect of an additional child on wages of women, regardless whether they work in full-time or part-time jobs, estimates suggest the existence of a wage premium for those with *more than one child*. But there is no wage premium associated to having *more than two children*, thus the effect is not increasing in number of children. This result is surprising since most of the research in the area have found a motherhood penalty or no effect at all. I hypothesized that

mothers of large families may put more effort to improve their labor positions or, alternatively, that employers may assign a higher value to what they believe are more committed workers. Allowing a differential impact of an additional child on wages by work category, estimates give similar results.

Observing an effect for having *more than one child* but not for having *more than two children* after IV controls are introduced reinforces the belief that the presence of children, more than the number of children, is what really matters. Future research should focus on evaluating how becoming a mother, more than the number of children, affects a woman's labor supply and wages.

However, a first approximation to the estimates can be made. In a model including women with and without children, having *at least one child* reduces the likelihood of choosing full-time or part-time work over the non working option. Also, instead of observing a motherhood wage premium as before, having a child seems to negatively affect wages. These results suggest that the impact of children on women's wages and labor supply is not linear, and should be cautiously addressed.

Table 11. Sample of all women
Dependent variable: Ln hourly wages

	Full-time	**Part-time**	**Ln hourly wages**	
			Full-Timers	**Part-timers**
At least one child	-0.9747*** (0.0422)	-0.5462*** (0.0720)	-0.0382** (0.0162)	-0.1425*** (0.0545)

Calculations use sample weights
*** significant at 1%, ** significant at 5%, * significant at 10%

Even though I cannot generalize the effects of having *more than one child* or *more than two children* on mother's labor outcomes to increases in fertility at any parity level, results are still useful. Chilean families are moving away from large numbers, with a particular reduction of families with more than three children.

Very low participation rates and higher unemployment rates when compared to men suggest that employment conditions are responsible for restricting women access to the labor market. A minimum entry wage, as well as very strict firing rules, severely restricts employment opportunities of women. Part-time jobs and, in general, more flexible jobs in terms of hours are more compatible with childrearing and household responsibilities. However, these alternatives are few and hard to find

in Chile. By creating more flexible employment opportunities, more women would be able to continue working during their childbearing years.

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