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The rise in female participation in Colombia: Fertility, marital status or education?

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ABSTRACT

Colombia has experienced a secular increase in the labor participation of urban women, going from nearly 47% in 1984 to 65% in 2006. We decompose the evolution of participation into changes in the composition of the population and changes in the participation rates by groups (defined according to the variables that appear most relevant: educational attainment, fertility and marital status). The increase in participation is driven by the increase in the participation rate of married or cohabiting women and women with low educational attainment. Fertility status appears to be less important. Changes in the population composition by educational attainment are also relevant in explaining the increase in participation. However, changes in composition by marital status or fertility are second order effects.

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Aumento de la participación femenina en Colombia: ¿fecundidad, estado civil o educación?

RESUMEN

La participación laboral femenina en las zonas urbanas ha aumentado de manera sustancial en Colombia, y ha pasado de cerca del 47% en 1984 al 65% en 2006. Descomponemos el aumento en la participación en lo que corresponde a aumentos en la tasa de participación de los diferentes subgrupos (que se definen según las variables más relevantes, que son en este caso logro educativo, estado civil y fecundidad) y cambios en la composición de la población. El aumento en la participación está jalonado por el aumento en las tasas de participación de las mujeres que están casadas o en unión libre, y de mujeres de bajo nivel educativo. La fecundidad contribuye menos a explicar el fenómeno. Los cambios en la composición de la población por niveles educativos también explican una porción sustancial, mientras que el efecto de los cambios en la composición de la población en términos de estado civil o fecundidad es muy pequeño.

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1. Introduction

Colombia has experienced a secular increase in female labor participation, which is one of the most profound changes observed in the labor market. Participation rates for women between 18 and 65 years of age in the 10 largest cities have increased from nearly 47% in 1984 to 65% in 2006. Many countries have experienced increases in female labor participation (see for example Elías and Ñopo, 2010, for an analysis of the Latin American experience, and Costa, 2000, for a description of the evolution of female participation over the

20th century in the US and other industrialized countries). However, the increase in Colombia's female participation rate has been particularly steep. According to Elías and Ñopo (2010), Colombia displayed the steepest increase in female participation in Latin America. While in 1980 the labor participation rate of Colombian females was the second lowest in the region, only above that of Costa Rica, by 2004 it was the highest in the region, equaled only by Uruguay.

This paper aims at better understanding the specific circumstances of this dramatic change in female participation. We first study the evolution of participation, taking into account the heterogeneity generated by socio-economic characteristics. In particular, we find that education, fertility and marital status are crucial in understanding the observed trends. The increase in the aggregate participation rate may be driven by both, increases in the participation rate of specific groups, and changes in the

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composition of women by observed characteristics. Therefore, we study both the evolution of female participation by the aforementioned characteristics, as well as changes in population composition. The groups that exhibited the highest increases in participation married women and women with cohabiting partners, women with low educational attainment and women with children younger than 18. However, there were also big changes in the composition of the population by these groups, the most important being a significant increase in educational attainment.

We perform two exercises to determine to what extent changes in the participation rate of particular groups, and changes in population composition, contribute to the increase in the labor participation of urban women. We estimate how the described covariates affect the probability of participation and then perform a decomposition exercise, following the methodology proposed by Elías and Ñopo (2010). Both exercises generate similar results: marital status appears to be the strongest driving force in the participation decision, followed by education. Fertility appears less relevant. Thus, the aggregate increase in female participation is mainly driven by a significant increase in the participation rate of population groups that traditionally had low labor market attachment: women who were married or cohabiting and women who had low educational attainment, regardless of their fertility status. Changes in population composition help explain the increase in participation, but to a lesser extent than changes in the participation rates of particular groups. In particular, the increase in the proportion of women with high educational attainment is also relevant in explaining the increase in participation. The changes in composition by marital status or fertility are second order effects.

2. Literature Review

The economic literature has focused on explaining what generated the increase in female participation in the US by associating it with fertility decisions of married women and how fast married women return to work after childbirth; with changes in the opportunity cost of home production¹; and changes in the wage structure, either in terms of the gender wage gap or the elasticity of the female labor supply to changes in their or their husband's wages. Other papers explore the transition process in itself.

Due to potential reverse causality between fertility and female labor participation, people have slow process of learning about the effects of female work on family and children (Fogli and Veldkamp, 2007). When instrumenting fertility with children's sex composition, fertility was found to have a negative effect on female labor supply (see for example Angrist and Evans, 1998, and Carrasco, 2001). Angrist and Evans (1998) find, however, that this channel explains a small fraction of the observed change in female participation between 1980 and 1990 in the US Francesconi (2002) jointly estimates the fertility and labor participation decisions and finds a negative relationship between labor earnings potential and fertility since high-earners have the lowest marginal utility of children.

Regarding the effect of changes in the opportunity cost of home production, Greenwood et al. (2005) suggest that the increase in female participation during the 20th Century in the US can broadly be explained by the decrease in the adoption cost of home production technology, mainly appliances. In addition to technological improvements in the production of nonmarket goods, Jones et al. (2003) test two hypotheses to explain the increase in the participation rate of married women in the US: the decrease in the gender wage gap and the potential inferiority of non-market goods in understanding

this change. According to their model, only the decrease in the gender wage gap has high explanatory power.

Blau and Kahn (2005) explore whether the increase in participation can be explained by changes in the wage structure. They find that a substantial fraction of the observed increase in female labor participation is due to rapid changes in supply during the 80's and 90's. They also find a 50% decrease in the own wage elasticity, as well as a decrease in the elasticity to the husband's wage.

More recently, Attanasio et al. (2008) propose a life-cycle model to explain the differences in labor participation of women born in the 30's, 40's and 50's in the US. Labor participation depends on child costs relative to earnings, returns to experience and the depreciation rate of human capital when out of the labor market. The calibration suggests that the increase in female labor participation is most likely driven by changes in the cost of children relative to lifetime earnings. Fogli and Veldkamp (2011) propose a model to explain the actual transition in the participation rates of mothers with children under 5 years of age in the U.S. between 1940 and 2000: both the 'S' shape (sharp increase, followed by deceleration and a slight decrease) and geographical variation. In their model, women learn about the effects of maternal employment on children and marriage by observing nearby employed women. As information accumulates, the effects of maternal employment become less uncertain, and more women participate. When the participation rate approaches the optimum (the real benefit of working), the increase in participation slows down.

In Latin America, Elías and Ñopo (2010) characterize the increase in the labor participation of married women in 14 countries and then decompose the evolution into components associated with changes in the composition of the population and with changes in the participation rates by groups. They find that for the sample of countries² the composition effects are relatively unimportant while the bulk of the increase in participation can be explained by the increase in the participation rate of specific groups of the population. Our analysis differs from that of Elías and Ñopo (2010) because they focus on the increase in female participation of married women in the region, whereas go a step back and consider the relative importance of marital status along with other variables such as education and fertility for the Colombian case in particular, which we find especially interesting. In addition to the decomposition exercise, we estimate how the described covariates affect the probability of participation.

For the Colombian case, there is little literature in the topic. Arango and Posada (2007) estimate the determinants of labor participation for married women in Colombia in a life-cycle model, and find using a pseudo-panel that the main determinants are past participation decisions, the education level, labor income taxes, having children between 1 and 2 years of age, and the presence of an unemployed individual in the household. The closest paper to ours is Robbins et al. (2009) who study, in a life-cycle model, the potential effect of increases in female wages on the observed increase in female labor participation in the country. Also using a pseudo-panel, they find that both the intertemporal and the uncompensated elasticities are positive but small in magnitude, so the evolution of female wages does not seem to be the main driver of female participation rates.

This paper contributes to the literature in several ways. First, we study the increase in female participation and identify education level, marital status and fertility as crucial covariates in characterizing the increase in participation in Colombia, while previous papers focused mainly on married women. Second, we decompose the aggregate increase in participation into changes in the participation rates of particular subgroups and changes in the

1. Jones et al. (2003) state that this hypothesis is only valid if we assume complementarity between home and market production.

2. Colombia is one of the countries included in the sample.

composition of the population, which is new in the country to the best of our knowledge. This generates two findings that are not obvious. On the one hand, in contrast with the observed trends in the U.S. where the bulk of the increase in female participation has been driven by mothers of young children, in Colombia women's fertility appears less relevant than marital status and education in explaining participation. On the other, we find that changes in population composition, such as the increase in education have very small effects on female labor participation.

3. Data Description

Since we are interested in the evolution of female participation over the last two decades, we use data available from the Colombian Household Survey (CHS), a repeated cross-section survey carried out by the National Statistics Department (DANE). The CHS collects information on demographic and socio-economic characteristics. In this paper we analyze women between the ages of 18 and 65 in the 10 largest cities³ for the period between 1984 and 2006⁴.

Mother-children relationships are identified for the majority of the women for which the CHS collects information but not for all of them. Because each household member in this survey is defined according to his/her relationship to the household head, all of the children of the household head can be clearly assigned to their mother. The same is true for the children of women who are domestic workers. However, all other children and women cannot be matched with certainty. Consider, for example, a household composed by six people: a male household head, his wife, their two children, another adult woman related to the household head, and a girl who is also related to him but is not his daughter (or step daughter). For these last two members, we cannot tell for sure if they are actually mother and daughter (note, however, that we do know that the girl is not the household head or his wife's daughter).

To address this issue, we consider two possible strategies: restricting our estimation sample to the women for which we have certainty about the identity of their children (i.e. household heads and wives of household heads) and using unmatched children in the household as a proxy for the children of women who are not household heads or their wives. We have calculated participation rates for marital status/fertility sub groups⁷ under each of these strategies and compared them to the participation rates obtained when all of the relationships are identified using the 2003 Living Standards Survey⁶. The second strategy (using unmatched children as a proxy for unmatched women's sons and daughters) proved to be the best, producing participation rates with very small bias. All

participation rates using this strategy are within one percentage point of the "true" ones, with the exception of the rate for divorced women with children, for which we calculate a participation rate of 86.12% when all relationships are identified and 84.12% when we use the described strategy. Thus, in all of the estimations in this paper we assign mother-children relationships using this rule whenever the true relationships are not identified.

4. The Evolution of Female Labor Participation in Colombia

In the past three decades Colombian women have exhibited major changes regarding fertility, education and labor market participation. Fertility (measured by the Total Fertility Rate) has decreased from 3,2 in 1986 to 2,4 in 2005 (Flórez and Soto, 2007). There was a reversal of the education gap: women have higher completion rates for primary, secondary and even college education than men. In addition, the gap in female-male participation in the labor market has declined substantially. Even though progress has been slower than in education and health outcomes, as in other countries, Colombia displayed the steepest increase in female participation in Latin America in the last three decades (Elías and Nopo, 2010). It is therefore an interesting case-study.

Whereas male labor participation has been stable, above 85% over the same period, females have substantially increased their labor market participation from nearly 47% in 1984 to around 65% in 2006 (See Figure 1). Despite the increase in female participation rates, their current participation rate still remains significantly lower than that of males. The bulk of the increase in the female participation rate was observed during the 1980's and 90's, whereas in the 2000's participation remained fairly stable⁷.



Figure 1. Participation rates (men vs. women).

Even though we have documented a substantial change in the extensive margin —participation rates—, there have not been major changes in the intensive margin —hours of work—. The mean hours of work for women decreased a little for most groups during our study period (Table 1).

3. Barranquilla, Bucaramanga, Bogotá, Manizales, Medellín, Cali, Pasto, Villavicencio, Pereira and Cúcuta.

4. The information collected in the Survey is comparable starting only in 1984. There was a change in the Survey's methodology starting 2007, and therefore the data are not strictly comparable and it is unclear how to make them comparable at this point. Thus, the period under study ends in 2006. Some definitions changed slightly in the CHS after 2000. We work with a version of the data that attempts to use a consistent definition of participation. However, in the empirical exercises presented later, we control further for this issue and evaluate the sensitivity of our conclusions to possible changes in the data after 2000.

5. We calculated participation rate for four groups: married with and without children under 18 and un-married (single or divorced) with and without children under 18.

6. The Living Standards Survey (LSS) differs from the CHS in that in the LSS it is possible to identify each and every child for each woman in the household but has only been collected three times over our study period. We used three different samples in our calculations: a full sample of women with their real number of children, a full sample of women using the children residing in their household as a proxy of their own children and finally a sub-sample of women composed by heads of household, spouses of heads of household or domestic workers with their real number of children. Full results for the described comparison are available upon request.

7. This increase has been a stable one (as shown in Figure 1). The participation rates of women do not seem to be related with the business cycle. For example, simple correlations between female participation rate and GDP growth are not statistically significant (calculations not included).

Table 1

Average weekly hours worked. Population aged 18-65 years old, 10 largest cities.

	1984-1989	1990-1999	2000-2006	1984-1989 vs. 2000-2006
Married/cohabiting men	47.4	48.4	50.5	Significant to 99%
Single/widowed/divorced men	51.4	52.3	56.4	Significant to 99%
<i>Married/cohabiting women</i>				
Without children under 18	44.24	44.38	43.22	Significant to 95%
Youngest child is 6-17	48.30	46.94	45.67	Significant to 99%
Youngest child is 0-5	43.28	43.76	43.73	—
<i>Single/widowed/divorced women</i>				
Without children under 18	46.45	46.15	44.73	Significant to 99%
Youngest child is 6-17	43.08	43.45	41.54	Significant to 99%
Youngest child is 0-5	46.52	46.09	44.05	Significant to 99%

Averages were estimated on the sample of women who work.

Table 2

Percentage of individuals working part-, full- and over-time by gender.

	1984-1989	1990-1999	2000-2006	1984-1989 vs. 2000-2006
Men working part-time, %	7.6	7.9	11.6	Significant to 99%
Women working part-time, %	18.4	18.8	25.8	Significant to 99%
Men working full-time, %	58.1	54.8	42.2	Significant to 99%
Women working full-time, %	55.3	56.5	45.4	Significant to 99%
Men working over-time, %	34.2	37.3	46.2	Significant to 99%
Women working over-time, %	26.3	24.7	28.9	Significant to 99%

Part-time: <35 h/week; over-time: >48 h/week.

There has been moderate change in the distribution of women working part-time vs. working full-time. As shown in Table 2, the bulk of the change happened in the period 2000-2006, while no major differences occurred between the first (1984-1989) and the second period (1990-1999). Whereas 55.3% of women worked full time between 1984 and 1989, 45.4% did in 2006. Most part of the difference, 10 percentage points, shifted from full to part-time work (which increased from 18.4% in the period 1984-1989 to 25.8% in the period 2000-2006) and the rest to over-time work (which increased from 26.3% in the period 1984-1989 to 28.9% in the period 2000-2006). In 2000-2006, roughly one in every 4 women worked part time. The distribution of hours worked by men displayed substantial changes. The percentage of men working full time decreased over the period of study (from 58.1% to 42.2%). Some of these men are now working part time and the majority shifted to over-time jobs.

5. The Relative Role of Marital Status, Education and Fertility

What is driving the dramatic increase in female participation rates in Colombia? Three characteristics appear crucial in understanding the evolution of female participation: marital status (married/cohabiting vs. single/widowed/divorced), education level (low, medium, high)⁸ and fertility (without children under 18, with children younger than 5, with children between 6 and 17 years of age but no children under 5). The participation rate within each category (married/cohabiting women, for example) is defined as the ratio between the labor force and the total number of women within each group (the ratio between the number of working women who are married/cohabiting and the total number of women who are married/cohabiting, for example). These rates can be understood as a measure of the probability of participating in the labor market conditional on belonging to any of the mentioned categories. Figure 2 shows the evolution of the participation rates of women by fertility, marital status and education categories. Panel 2A shows the evolution in participation for women disaggregated by fertility.

8. Low: incomplete secondary education or less. Medium: completed secondary but no tertiary. High: Some tertiary education or more.

Women with children between 6 and 17 years of age increased their participation rates the most; the participation rate for women with children below 5 is lower than the rate for women with children between 6 and 17 years of age for the most part of the analyzed period.

By marital status, married/cohabiting women exhibit the greatest increase in labor participation. Panel 2B shows that at the beginning of the period the difference in participation rates for women married or cohabiting and single or divorced women was around 26 percentage points; by the end of the period, the gap was only 12 percentage points.

The higher the education level, the higher participation rates are. However, as Panel 2C shows, the *increase* in participation rate was the highest for women who belong to the low education group, followed by women with medium education. Therefore, three main groups have increased their participation. The significant increase in female participation rates has mostly been driven by women with *low educational attainment* (in contrast to women with medium or high educational attainment) who increased their participation rate from 43% in 1984 to 58% in 2006 by women who are *married or cohabiting* (in contrast to single/widowed/divorced women) who increased their participation rate from 34% in 1984 to 60% in 2006 and by women with children (in contrast to childless women); women with children between 6-17 years of age increased their participation from 45% in 1984 to 73% in 2006, and women with children under 5 years of age increased their participation from 44% in 1984 to 69% in 2006.

The portrayed changes in the participation rates of particular groups are meant to be only descriptive, since the *true* relative importance of factors is calculated by simultaneously conditioning on all factors.

Two types of changes may have driven the increase in the participation rate: increases in the participation rate of specific groups, and changes in the *composition* of women by group. Let us now turn to the observed changes in the population composition. Figure 3 shows the evolution of the composition of women by fertility, marital status and educational attainment.

Because of the selected age range (18-65 years of age), our sample includes women in less-fertile ages and therefore a significant

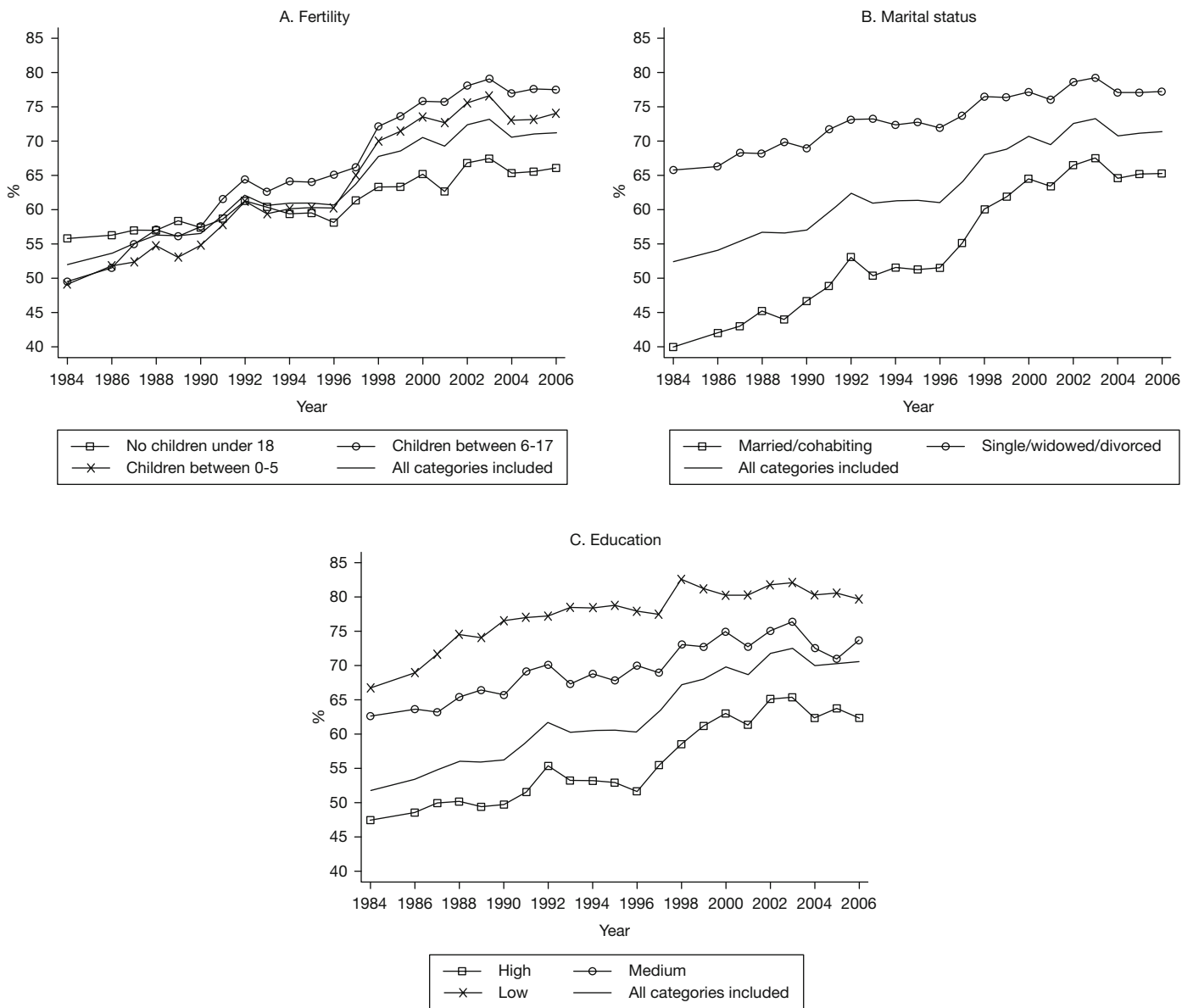


Figure 2. Changes in participation rates.

fraction of women have no children under 18⁹. Panel 3A shows that at the beginning of the period there were more women with children between 0-5 years of age, while by the end of the period there were more women with children between 6-17 years of age. As displayed in Panel 3B, even though there is some variation during the period under study, the percentage of women who are married or cohabiting is roughly half, especially at the beginning and end of the period. However, during the 1990's, the proportion of married women was slightly higher.

The most substantial change in composition has to do with educational attainment (Panel 3C). Colombian women reversed the education gap: today women have higher completion rates

for primary, secondary and even college education, than men (Peña, 2006). During our study period the proportion of women with low education decreased from 75.6% to 42.64%. This implies that the proportion of women with medium and high educational attainment increased from 15.4% and 9.99% to 29.79% and 27.57%, respectively. That is, the percentage of women with a college degree almost tripled.

Again, the true relative importance of factors can only be determined by simultaneously conditioning on all factors; the portrayed changes in the composition of particular groups are merely descriptive.

There have been substantial changes both in participation rates of particular groups as well as in the composition of women in the workforce. Therefore, it is important to determine which of these variables (education, marital status and fertility) contributed the most to the increase in the female participation rate, and how much of the increase in the participation rate is due changes in the population composition. To address these questions, we perform

9. In addition, it is important to note that Colombian Household Surveys only include information about children who live in the surveyed household; information about children who do not live with their mothers is not included. This increases the proportion of women without children, especially among elderly women who are less likely to be currently living with their sons/daughters.

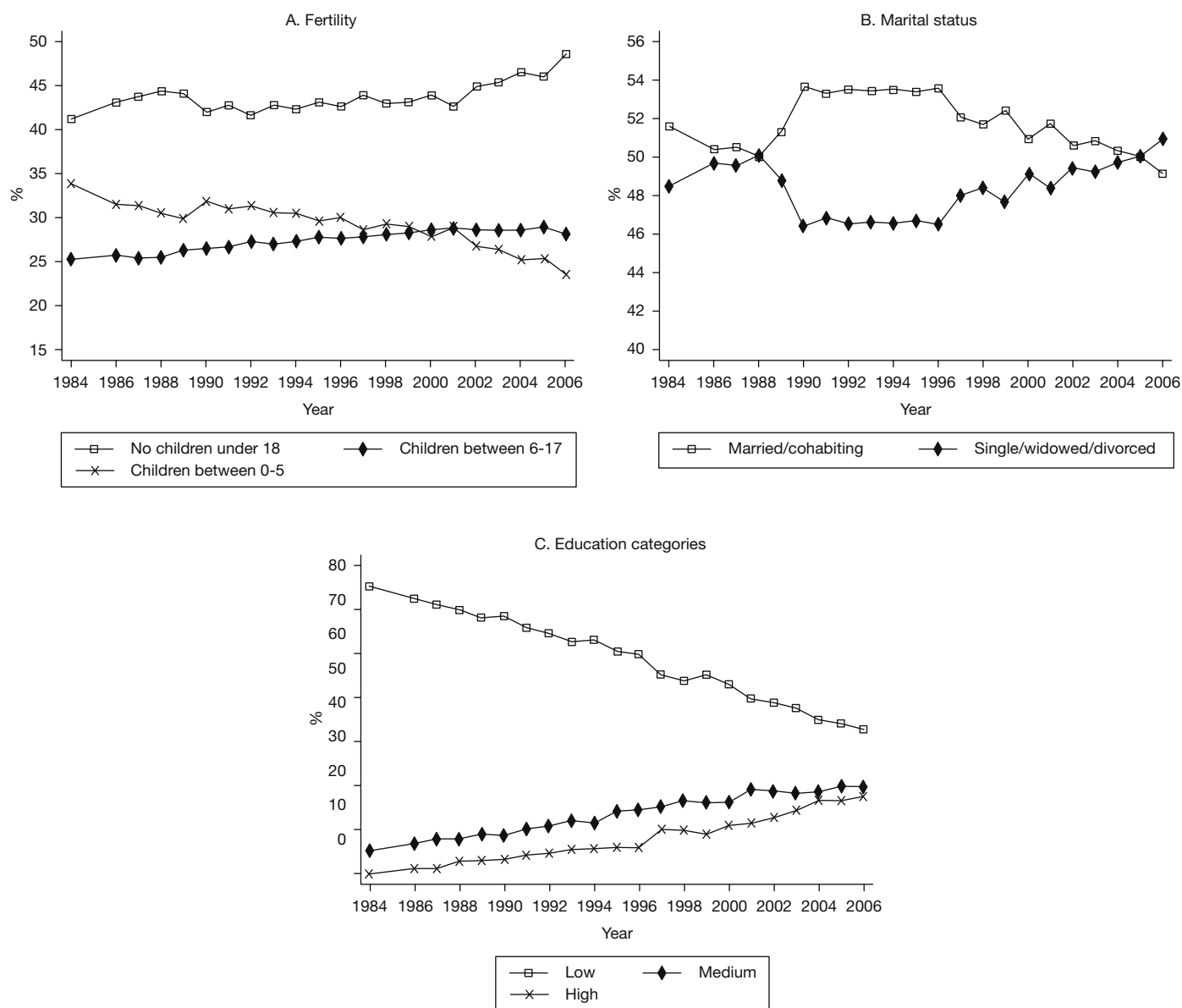


Figure 3. Changes in composition of women by groups.

two exercises. First, we estimate how the described covariates affect the probability of participation. We then perform a decomposition exercise, following Elías and Ñopo (2010). In their analysis, Elías and Ñopo (2010) explain the increase in the participation rate of married women in Latin America. Instead of focusing on married women, we take a step back; we evaluate the relative importance of marital status, educational attainment and fertility in explaining the observed increase in female labor force participation. In addition, whereas Elías and Ñopo (2010) study a group of countries, we focus on the Colombian case that has displayed the steepest increase in the participation rates of women in the region. This methodology has the advantage that it generates in own opinion the most intuitive decomposition results as compared to other available methodologies, with no clear draw-backs.

Table 3 presents the results of a probit model for female labor participation at the individual level, pooling all observations from 1984 to 2006. The dependent variable is a dummy capturing whether a particular woman participates in the labor market

or not. The main regressors are dichotomous variables that indicate the individual's marital status, fertility and educational attainment. We also include time dummy variables: 1984-1989, 1990-1995, 1996-2001, 2002-2006, to divide the time period in uniform intervals¹⁰. This allows us to have a better understanding about when exactly do the changes occur. The main explanatory variables (fertility, educational attainment and marital status) are also interacted with these time dummies. Additional controls also include personal non-earned income, other family income, age, age squared and city fixed effects¹¹. For each year we group all the quarters to get the yearly information. Finally, as mentioned in

10. The last period is forcibly one year shorter than all other ones.

11. Personal non-earned income as well as other family income are included since it is expected that an increase in these variables would make women more prone to make a living from these non-labor sources of income rather than from working. City fixed effects are included to capture the potential differences that may exist between cities in employment dynamics, cultural perceptions toward female participation and characteristics of other markets.

Table 3
Marginal effects for female labor participation. Dependent variable: labor force participation.

Variable	Effect	Interaction with time dummy variables		
		1984-1989	1990-1995	1996-2001
Married/cohabiting	-0.193 ^a (0.002)	-0.146 ^a (0.003)	-0.107 ^a (0.003)	-0.051 ^a (0.003)
Low education	-0.123 ^a (0.003)	0.011 ^b (0.003)	-0.034 ^a (0.003)	-0.025 ^a (0.004)
Medium education	-0.048 ^a (0.003)	0.046 ^a (0.004)	0.009 ^a (0.005)	-0.001 ^c (0.005)
Children under 18	0.023 ^a (0.003)	-0.038 ^a (0.004)	-0.017 ^a (0.004)	0.003 (0.004)
Children under 5	-0.018 ^a (0.003)	0.028 ^a (0.004)	0.013 ^a (0.004)	0.014 ^a (0.004)
Age	0.067 ^a (0.000)			
Age squared	-0.001 ^a (0.000)			
Non-earned income	-0.071 ^a (0.000)			
Other family income	-0.002 ^a (0.047)			
ECH	0.048 ^a (0.003)			

^aSignificant at 1%.

^bSignificant at 5%.

^cSignificant at 10%.

Probit estimation. Omitted period is 2002-2006. Low education: less than High School; medium education: complete High School but no tertiary education. High education (omitted): some tertiary or more. Non earned income and other family income are measured in million pesos (2008). ECH is a dummy to indicate that the data comes from ECH (new methodology introduced in 2000 Q3). See text for details. City fixed effects included but not reported. Sample size: 2 100 142; pseudo R²: 0.13.

the Data section (see footnote 4), some changes were introduced to the Colombian Household Survey in the second semester of 2000. These changes are likely to affect the level of the participation rate, but not its relationship with our main variables. To control for this change, we include a dummy variable that indicates that the new methodology was used at the time (ECH)¹².

The coefficients portrayed in the first column capture the relative importance of each of the factors in the 2000-6 period. Marital status appears to be the strongest driving force in the participation decision: being married/cohabiting decreases by 19,3 percentage points (pp) the probability of labor market participation compared to being single/divorced/widowed. The effect of education is also important, but smaller. Having a low level of education (incomplete high school or less) decreases the probability of participating by 12,3 pp. when compared to women who have some college education. Similarly, women who are high school graduates but have no college education have a participation probability that is almost 5 pp lower than those with some college. Women's fertility appears less relevant than marital status and education in explaining participation; having children under the age of 5 decreases the probability of participating by 2pp as compared to childless women, while having children between the ages of 6 and 18 years increases the probability of participating by 2pp. This is in contrast with observed trends in other countries such as the U.S. where the bulk of the increase in female participation has been driven by mothers of young children.

Not only does marital status have the strongest impact on the decision to participate between 2000 and 2006, but it is also the factor whose effect on labor participation has changed the most throughout the analyzed period. This is captured by the coefficients on the interaction terms between our main explanatory variables

12. The results of this estimation are not sensitive to the inclusion of this dummy variable.

and the time dummies. Because the omitted period is 2002-2006, the coefficient associated to the interaction with the 1984-1989 dummy quantifies the change in the coefficient of each of these variables in the whole period under study. Clearly, the effect of marital status has changed the most during the time period: an absolute value of 14,6 pp. The changes in the coefficients associated with educational attainment have not been as dramatic as those displayed by marital status. The sum of the variable's marginal effect and that of the interaction captures the effect of the variable at the beginning of the period. In 1984-1989 being married decreased the probability of participating by 33,7 pp, while having a low (medium) education level decreased it by 11,2 (9,3) pp. when compared to the most educated women. Being a mother of children between the ages of 6 and 18 years decreased the probability of participating by 1,5 pp in 1984-1989, while being a mother of children under the age of 5 increased the probability of participating by almost 1 pp in the same period.

Let us now turn to the second exercise to determine the relative contribution of changes in the relevant covariates (education, marital status and fertility) and the rate of participation of each group in the secular increase in female participation in Colombia. We follow the methodology proposed by Elías and Nopo (2010). They decompose the changes in the labor force participation into the participation rate of specific subgroups of the population and population composition components. The basic idea is to express the female labor force participation l_t at time t , as

$$l_t = \sum_k m_t(K)P_t(K)$$

where $m_t(K)$ is the labor force participation rate in period t for the group K , and $P_t(K)$ is the fraction of women in group K , in period t . The change in women labor force participation through time can then be decomposed into a change in participation rates within groups and changes in the composition of the population, that is,

$$l_{t+1} - l_t = \sum_k P_{t+1}(K)[m_{t+1}(K) - m_t(K)] + \sum_k m_t(K)[P_{t+1}(K) - P_t(K)].$$

We first apply the methodology to Colombian data by separately analyzing the relative contributions of changes in the composition and participation rates of groups within each of the explanatory variables (educational attainment, marital status and fertility) to the aggregate change in participation rate. These analysis are descriptive, since they consider only one dimension at a time. The relative importance of factors is then captured by considering all explanatory variables simultaneously.

Table 4 displays the decomposition results for marital status. In this and in all the other decomposition results that follow, we divide the time period under analysis in calendar decades (i.e. 80's, 90's, 2000's). We pick these divisions to facilitate the analysis but all the qualitative results are robust to changes in this categorization¹³.

Changes in the participation rates of specific subgroups drive the aggregate trend, while changes in composition are only marginal. For instance, the changes in participation rates for the two marital status categories we have defined account for more than 95% of the changes in the labor force participation (LFP) rate during the decade of the 1990's. Although the two subgroups display changes in their participation rates of a relevant magnitude, the contribution of the change in the participation rate of married/cohabiting women is more than twice the size of the contribution for single/divorced women. The

13. In particular, the qualitative results do not change when we set the cutoff between the second and third periods to be 2001. This is important because it suggests that the results are not sensitive to the change in CHS definitions after 2000. Results for this exercise are available upon request.

Table 4

Decomposition of changes in women labor force participation by marital status.

Year	Changes in participation rates			Changes in composition			Total change in LFP rate
	Total	Married/cohabiting	Single/divorced	Total	Married/cohabiting	Single/divorced	
1984-1990	0.051	0.037	0.015	-0.005	0.007	-0.012	0.046
1990-2000	0.133	0.092	0.041	0.006	-0.011	0.017	0.140
2000-2006	0.004	0.004	0.000	0.002	-0.010	0.013	0.006

LFP: labor force participation.

relative importance of composition changes becomes relevant only during the period 2000-2006, when it accounts for almost one third of the changes in LFP rate. However, the changes in LFP rate during the period of study (1984-2006) occur mainly before 2000, making this last change insignificant in terms of its relevance for explaining the overall changes in female LFP rate over the last decades.

Results are very similar when decomposing the increase in participation by fertility (Table 5). As it was the case with marital status, changes in the participation rates by subgroups account for virtually all of the change in female labor force participation. The bulk of the increase in participation is accounted for by the increase in participation rates of women with young children; between 6-17 (0.052 out of 0.138 during the 1990's, for example) and women with children between 0-5 (basically the same magnitude). The contribution of changes in group composition to explain the total change in female labor force participation is minuscule during most of this period.

By education (Table 6), the situation is somewhat different since changes in composition are important, although most of the change still comes from changes in participation rates for the subgroups we have defined. Changes in composition account for roughly one fourth of the increase in participation between 1984-1990 and 1990-2000 (0.011 out of 0.044 and 0.033 out of 0.14, respectively) and are even more important than changes in rates during the relatively stable period of 2000-2006. Most of the composition contribution to the increase is due to the changes in the proportion of women with a high and medium educational attainment. Furthermore, the changes in the proportion of women with low educational attainment lead to a lower LFP rate and are quite large in magnitude. This is also the group for which the participation rate component has the largest contribution (0.016 out of 0.035 and 0.07 out of 0.1, during the 1980's and 1990's, respectively).

The decompositions described above show that the increase in participation has been mostly driven by changes in participation

rates of particular subgroups rather than by changes in the composition of the population. However, we still need to determine the *relative* importance of the increase in the participation of the different groups. In other words, we need to find the contribution of each factor conditional on possible changes in the other explanatory factors. To do this we combine all of the possible categories in the three covariates: marital status (married/cohabiting and single/widowed/divorced), fertility (no children under 18, children between 0-5, and children between 6-17) and education (low, medium, and high), resulting in 18 groups. The contribution of the changes in participation rates and composition of each of these 18 groups to the overall changes in labor force participation is presented in Table 7.

When combining all categories we find that changes in participation rates account for the majority of the total change in labor force participation. For example, during the 1990's, when most of the increase in the participation rate occurred, 73% of this change comes from changes in participation rates (11 pp out of 15 pp). Changes in the population composition account for the remainder. This effect is smaller, but it is not negligible.

Overall, the single most important force explaining these big changes appears to be the increase in participation rates for low educated married women, regardless of their fertility status. However, there are very interesting differences in the relative contributions of changes in participation rates for subgroups between the time periods defined. For instance, fertility seemed to be especially important during the 1980's. Looking at the contribution of the participation rates for married women with low or medium educational levels, the groups with children in both age ranges are the largest contributors to the overall change. The opposite is true for unmarried women: among these women, the increase in participation rate for women with no children has the largest impact on the overall change in LFPR.

Table 5

Decomposition of changes in women labor force participation by women's fertility.

Year	Changes in participation rates				Changes in composition				Total change in LFP rate
	Total	No children under 18	Children 0-5	Children 6-17	Total	No children under 18	Children 0-5	Children 6-17	
1984-1990	0.046	0.007	0.021	0.018	0.001	0.004	0.005	-0.009	0.046
1990-2000	0.138	0.034	0.052	0.052	0.001	0.010	0.011	-0.020	0.140
2000-2006	0.010	0.004	0.005	0.001	-0.005	0.027	-0.003	-0.029	0.006

LFP: labor force participation.

Table 6

Decomposition of changes in women labor force participation by women's education.

Year	Changes in participation rates				Changes in composition				Total change in LFP rate
	Total	Low	Medium	High	Total	Low	Medium	High	
1984-1990	0.035	0.016	0.006	0.013	0.011	-0.028	0.019	0.020	0.046
1991-2000	0.104	0.072	0.025	0.008	0.033	-0.069	0.045	0.057	0.140
2000-2006	-0.008	-0.003	-0.004	-0.001	0.016	-0.060	0.026	0.050	0.006

LFP: labor force participation.

Table 7
Decomposition of changes in women labor force participation by fertility, marital status and education (percentage points).

Marital status	Education	Children	Changes in participation rates			Changes in composition		
			1984-1990	1990-2000	2000-2006	1984-1990	1990-2000	2000-2006
Married/cohabiting	Low	No children under 18	0.017	1.104	0.063	0.260	-0.020	-0.052
		Between 6-17	0.663	2.576	-0.265	-0.090	-0.900	-1.447
		Under 5	0.558	1.988	-0.114	-0.857	-2.140	-2.030
	Medium	No children under 18	0.065	0.216	-0.157	0.143	0.426	0.608
		Between 6-17	0.344	0.286	0.170	0.314	0.767	0.651
		Under 5	0.047	0.948	-0.345	0.583	0.589	-0.279
	High	No children under 18	0.162	0.086	-0.203	0.271	1.082	1.051
		Between 6-17	0.177	0.179	-0.070	0.567	1.007	0.695
		Under 5	0.123	0.383	-0.144	0.458	0.277	0.612
Single/divorced/widowed	Low	No children under 18	-0.042	0.688	-0.521	-1.274	-2.465	-0.810
		Between 6-17	0.335	0.586	0.041	-0.397	-0.004	-0.747
		Under 5	0.157	0.458	-0.125	-0.742	-0.810	-1.046
	Medium	No children under 18	0.197	0.534	-0.442	0.411	0.929	0.762
		Between 6-17	-0.052	0.249	-0.103	0.299	0.792	0.550
		Under 5	0.023	0.153	-0.045	0.068	1.334	0.167
	High	No children under 18	0.346	0.494	-0.316	0.482	2.028	1.970
		Between 6-17	0.101	0.111	-0.014	0.185	0.686	0.579
		Under 5	0.099	0.082	-0.037	0.051	0.480	0.296
Total			3.318	11.123	-2.628	0.733	4.058	1.528

Fertility becomes less important for married women with low and medium education during the 1990's. Although the contribution of married women with children is still larger than that of women without children, the difference between these groups is dramatically smaller than it was during the 1980's. Among unmarried women, the group with the lowest educational level has an important contribution to the rising LFPR. Also, as in the 1980's, women with no children seem to be especially important.

The trend is dramatically reversed in the 2000's. The contribution of participation rates is still stronger than that of the composition of the population but the direction of the effect is the opposite: participation rates by subgroups drive the overall LFPR down. The strongest drops come from unmarried women with no children and married women with small children. These were precisely the groups that had pulled the participation rate upwards during the previous decades.

Regarding the contribution of changes in composition, there are also some interesting facts. As discussed earlier, they account for a significantly lower fraction of the overall change than the changes in participation rates. The changes in composition of some groups had strong effects on the overall LFPR. However, these effects tend to cancel out because they tend to go in opposite directions. For example, the contribution of changes in the fraction of women with young children in the low education group during the 1990's is one of the single most important forces, decreasing the participation rate by more than 2 pps by itself. The same is true for the change in the number of unmarried women with no children in the same decade. Finally, the increase in the fraction of highly educated unmarried women with no children has an overall contribution of almost 4.5 pps between 1984 and 2006.

6. Conclusions

In this paper, we have explored and identified the main forces behind the large increase in female labor force participation over the last two decades in Colombia. To show this, we have decomposed the evolution of participation into changes in the composition of the population and changes in the participation rates by groups (given by educational attainment, fertility and marital status). We found that the increase in overall participation is mainly driven by the increase in the participation rate of women with low education levels who were either married or cohabiting regardless of their

fertility status, while changes in the population composition are smaller, but particularly relevant in the case of educational attainment and the increasing fraction of highly educated unmarried women with no children.

Future research should focus on the mechanisms and causes of this increase in participation rates by groups. The specific contribution of this paper is mainly to identify the main driving forces and thus guide future work on the subject. There are many competing, but not mutually exclusive, hypotheses as to what has caused this particular change in the Colombian labor market. Because of the nature of the available data (a series of cross-sections), it is not possible for us to explore the plausibility or relative importance of the different hypotheses. However, we describe them below. Some of them are more consistent than others with our findings and therefore more likely to be powerful explanations.

Theories that attempt to relate the cause to changes in the composition of the population, in particular to the big changes in educational achievement observed during this same period, although relevant and important, do not seem appropriate to explain a large fraction of the observed increase in LFPR, based on our results. Also, a natural conclusion from this paper is that the explanations are mainly related with increased participation among less educated women and those who are in a marital union rather than differences between mothers and childless women.

Take the increasing availability of childcare, for instance. This should affect female participation by decreasing the value of the outside option for mothers. However, even though this can definitively be related to the participation of women with children, the results in this paper suggest that the cause of most of the increase in participation should be looked for elsewhere. This also implies that the labor regulations passed in the country during our study period that are aimed mainly at mothers have a limited potential to explain the observed increase in female participation rates.

There are other explanations that are somehow more consistent with what we have found here. The increasing chance of divorce should affect (and be affected by) human capital accumulation through job experience and hence labor force participation. This, combined with the high levels of income inequality in the country may have fostered an increase in the labor participation of women. This is consistent with the results found in table 7, especially when we refer to highly educated women. As discussed in the previous section, the increasing fraction of highly educated unmarried

women with no children, plausibly related to higher divorce rates and delays in age at first marriage, is one of the single most important factors contributing to the changes in LFPR between 1984-2006. Also, cultural changes in the perception of the role of women should increase the participation of those women who are usually less attached to the labor market (low educated, for example) and involved in traditionally female roles (married women and mothers). This idea is explored for the United States by Fernández and Fogli (2009). Finally, the changes in the wage structure, particularly the decrease in the wage gap between men and women, should increase the participation of (all) women as well. It is not implausible that married and cohabiting women with low educational attainment are more likely to be the 'marginal' women for which the wage changes would lead to a change in the labor force participation decision. Also, the changes in the opportunity cost of home production happened later in Colombia than in developed countries. The adoption of home production technology, mainly appliances, may have played a significant role.

The previous list is by no means exhaustive. We have included it, however, as a way to suggest future lines of research that are consistent with the findings of this paper, as well as to discard other ones that are less so. This should encourage and be helpful to other researchers who attempt to identify the causes of steep increase in female labor participation rates in Colombia over the last couple of decades. As we have shown, women who are married or cohabiting substantially increased their participation, but it is still below that of single, divorced or widowed women. Although this women may face home responsibilities (beyond childrearing), we believe that there is scope for public policy that attempts to engage women in market activities. In Colombia, young women are more educated than men and are one of the very valuable resources that can make a difference regarding long run economic growth. Given this paper's findings, we believe that fostering gender equality in the labor market, especially for low education women, can improve labor market outcomes and thus achieve potential growth.

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