Socioeconomic and Spatial Determinants of Fertility amongst Young Women [1]

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Summary

The main objective of the paper is to analyze the spatial patterns in the reproductive behavior of young women in Mexico in a context of deep social inequalities. We study the spatial distribution of early fertility patterns and the effect of structural covariates at the municipality level. The data source is the 2010 Population Census. Women were asked about the date of birth of last child born alive. With this data, fertility rates for women aged 15 to 19 years are calculated for a 10% sample of 5.5 million women in these ages. The Census provides also data on structural conditions (education, labor, family systems and marriage markets, access to medical services) at the municipality level. First, we calculate the Moran's I statistic in order to test the global spatial autocorrelation in the fertility rates; we also analyze the clustering of fertility rates in the municipalities using Local Moran's I index. We estimate a Linear Regression and, in order to control for the spatial variations of the effects of structural variables on fertility behavior, we estimate a spatial lag model. Our findings are expected to be useful inputs to efficient social policies in order to reduce fertility among young women.

Background

In spite of the notable reduction in fertility during the last five decades, current fertility level in Mexico is well above the long desired replacement level. In the first decade of the present century, the decline has been modest, mainly amongst younger women (Mier y Terán, 2011).

Increases in the contraceptive use facilitated by the governmental family planning programs made possible the fertility reduction. Programs have been mainly targeted on adult women to limit their family size. Fertility levels have thus declined as a result of the reduction in the final family size, while the timing of first births has not been greatly modified (Miranda, 2006; Solís et al., 2008).

Profound social transformations concurred with the fertility decline. The rapid urbanization process, the widespread of the educational system and the growing levels of female participation are some of the changes tightly related to family values. People increasingly experience living in cities, where less traditional ideals prevail and education and work opportunities are greater. Formal education among women has been growingly valued as a result of the increasing female labor force participation; women have greater expectations of personal development. As a consequence, the opportunity costs of childbearing have augmented and the economic value of children has decreased.

The socioeconomic inequities that characterize the Mexican society cause that even amongst recent birth cohorts, poverty hinders some sectors of the population from remaining in school for longer periods, mainly in the southern regions and rural areas. Most students attain only middle education and access to higher education continues to be restricted to some sectors in the cities. Concerning the labor markets, trends towards greater precariousness (high levels of underemployment, and low salaried and unstable jobs) have caused instability in life opportunities for the majority of the population; especially young people face growing difficulties in order to get a stable job and achieve economic independence.

Family size has become small in average, but notable differences in the patterns of family formation persist. The choice of remaining childless starts to be perceived as possible among certain sectors while big families remain valued among others. The experience of maternity at very young ages coexists with the postponement of fertility until relatively late ages among women with professional studies (Mier y Terán, 2013). However, early maternity continues to be valued, frequently associated with the conjugal couple formation. The pregnancy and birth of the first child and the couple formation are tightly interwoven so that one event triggers the other. This happens at early ages mainly among low social sectors with scarce education and in rural areas (Stern y Menkes, 2008).

Migration in Mexico has also affected reproductive patterns. Among others, selectivity by sex in internal and international migration has caused unbalances between males and females in different regions. Particularly, large flows of international emigration to the United States have been mainly of males, so that in the communities of origin the sex ratio of the population in reproductive ages is particularly low, affecting marital and fertility patterns. Being never married and childless is more common for women in states where men are relatively less numerous. It has also been shown that the effect of international migration on sex ratios is geographically concentrated (Raphael, 2013).

Economic development in Mexico has been characterized by profound regional inequalities (Aguilar y Graizbord, 2001). The spatial perspective allows a better understanding of social inequalities. Identifying the geographical areas where young women have higher risks of early fertility and studying the factors of the social context that affect young women's fertility provide new elements to guide social policies so that they are more efficient by taking account for the local context.

In spite of social policy being targeted at an aggregate level, most research on this topic is focused in individuals. To the best of our knowledge, no recent studies on spatial patterns of fertility at young ages in Mexico have been undertaken.

In this paper, we propose a spatial approach to analyze variations of teenage fertility at a macrolevel. People in local areas share norms and values and socioeconomic conditions that may shape their ideals and behavior. Besides the cultural background, young people share local schools, labor and marriage markets, other socialization spaces and access to medical services which may influence the timing of first giving birth and may vary between regions.

As theoretical framework, this study is circumscribed in the perspective of gender system and the diffusion approach. The different theoretical approaches developed to explain fertility decline associate the process of modernization with the raise in the childbearing costs and the decline in the economic benefits of children. The gender perspective emphasizes the gender basis in the division of labor; contexts with gender systems that constrain women's education and labor opportunities have a positive effect on fertility through the lowering of the costs of childbearing (Oppenheim Mason, 2001). In the diffusion process, innovation concerning fertility ideas and practices expands through persons, social groups and regions, which may occur independently of social and economic conditions (Bongaarts y Watkins, 1996). In contexts where social interaction is intense, differences decrease and the proximity to a source of change favors a fertility reduction.

The main objective of the paper is to study the spatial variations of teenage fertility rates at the municipality level and the effect of structural covariates in Mexico. We apply multivariate statistical techniques to analyze macrolevel variations of the reproductive behavior of young women, which may suggest a diffusion process. The explanatory factors are education and work opportunities, linked to the local social and economic conditions, and the sex ratio, more related to the demographic settings and marriage market conditions.

We expect the findings of this paper to be useful for policymakers in identifying municipalities and regions associated with higher risks of early childbirth and recognizing structural determinants of these patterns in order to design effective strategies.

Childbearing at young ages

Young age at first birth is a strong predictor of adverse adult outcomes. Mainly when it occurs at very young ages, maternity has a negative impact on the family and the society. Studies point out that women who experience maternity during adolescence have greater risks of negative social and economic outcomes than do women who postpone childbearing (Di Cesare y Rodríguez, 2006; Flórez y Núñez, 2002; Naciones Unidas, 1989).

Among others, maternity at these early ages favors low levels of education and participation in the labor market; when working, young mothers have more precarious jobs and lower incomes. An early timing of the birth of the first child can act as a trigger of an accumulation of disadvantages in later stages of life and as a potential determinant of intergenerational transmission of poverty (Saraví, 2009; Rodríguez Vignoli, 2000). However, having an early birth is also a probable a consequence of poverty. Among social sectors with low education and in poverty, reproductive life starts early, often during the adolescence.

In the relationship between the timing of entry into parenthood and the female education and work achievements, recent findings stress the role of previous disadvantages young women face before becoming pregnant. For the United States, it is shown that the educational paths diverge between young mothers and non-mothers before the former become pregnant (Stange, 2011). Based on Mexican data, Azevedo, López Calva and Perova (2012) assert that "the opportunities of women who become pregnant as teenagers to receive education and progress toward rewarding and fulfilling jobs are limited regardless of their fertility decisions."

Qualitative studies have shown that the desire to get pregnant of Mexican young women, mainly from the poorest sectors, obeys to the lack of opportunities they have of a personal development and the early abandonment of school; also, society highly values marriage and motherhood as their gender roles (Stern, 2012).

However, high teenage fertility in Mexico is also associated to the lack of access to adequate family planning services. In 2009, only half of young women aged 15-19 currently pregnant were expecting a planned birth. Besides, more than one in every five sexually active young women face unmet need for family planning (Mendoza et al., 2010). In spite of the overall fertility decline, these figures for teenagers have not drastically changed in the last three decades.

Family planning programs in Mexico have been pointed out as failing to provide adequate services for young people's specific needs. Lack of confidentiality, insufficient respect of autonomous decisions and lack of care for sexual intimacy are some of the deficiencies of the reproductive health services for the young people (Católicas por el Derecho a Decidir, 2009).

Childbearing at young ages and education and labor opportunities

Education is the variable most frequently used to explain fertility patterns. Educated women are more motivated to have smaller families and have greater access to reproductive health services. Rising levels of education favors the delay of marriage and the reduction in the family size (Naciones Unidas, 1994). However, the causal link is complex and deserves special attention in order to better understand the demographic and social change (Bledsoe et al, 1999).

In general, education increases the election choices and its social and cultural dimensions cause differences in the couple formation and fertility patterns (Gómez de León, 2001; Naciones Unidas, 2001).

The level of education affects costs and benefits of children. Increases in education cause the reduction in the benefits of children and the increase in their costs (Bongaarts, 2010). Women who want to achieve higher levels of education and have more favorable job perspectives are willing to postpone the birth of the first child, and they have access to efficient contraception. Among more educated women, an unintended pregnancy will mean increasing opportunity costs.

In Mexico, the labor markets for the majority young people with low levels of education are characterized by instability, low salaries and scarce or null social benefits (Mora y de Oliveira, 2010). In these labor contexts, young women's opportunity costs of having a child are relatively low. Only more educated women may have access to better jobs and thus bear higher opportunity costs of childbearing.

The expansion of the educational system has resulted in almost all children attending school; a growing proportion of children is finishing the six years of primary school at ages 11 or 12 and attending secondary school. Some children start to leave school as early as age 12 because families cannot afford the education costs and children either have to work for a salary or help at home. On the other hand a growing minority of young people study tertiary education and attain professional studies. Mexican education is thus characterized by its great heterogeneity.

In this context of social inequalities, it is suggested that the opportunity costs of having a child may be much lower for young women with scarce education and job opportunities who become pregnant than for women who delay childbearing (Azevedo, López Calva and Perova, 2012). As the authors assert, "The decision to have a baby early may not be as irrational as it is perceived given the poor educational and economic opportunities they face."

In this paper, we do not aim at finding a causal relationship between early fertility and education and work opportunities. The objective is to measure the strength of the relationship in the country as a whole, once having controlled for the spatial autocorrelation effect.

Migration and marriage markets.

In 2010, estimations show that around 10% of the Mexican born population lives in the United States and 5% of households have at least one migrant member abroad (Zenteno, 2006). Migration to the United States has traditionally had a strong male component.

In contexts where international migration is common, young women who remain in their local settings may delay marriage and childbearing, and increasingly invest in schooling and participate in the labor markets (Raphael, 2013). For Mexico, the author observes that decreases in time in the relative supply of males are related to higher proportions of unmarried and childless women.

Internal migration flows are an important feature of the demographic dynamics as well. People move mainly from less developed to more developed regions where labor markets are more dynamic and better quality services are provided. In general sex imbalance caused by internal migration is not as large as in the case of international migration but varies between regions.

The scarcity of suitable partners is expected to be a crucial effect of migration on fertility at young ages. We use the local sex ratio as a proxy of marriage markets greatly affected by the differential intensity of migration by sex. As fertility at young ages is so closely linked to nuptiality, following the search theory, we pose that when men are relatively scarce, young women must wait longer to find a suitable spouse and have a child than in contexts with relative abundant males.

To summarize, we expect clustering in space of similar teenage fertility rates and local spatial autocorrelation. We also expect contexts where the education and labor opportunities are limited and sex ratios are higher to have higher teenage fertility rates.

Data and research methods

We develop a spatial analysis to explain variations between municipalities in the fertility rates of young women. We calculate the Moran's I statistic in order to test the global spatial autocorrelation in the fertility rates, and analyze the clustering of high and low values of fertility rates in the municipalities using Local Moran's I, a local indicator of spatial autocorrelation (LISA).

We then proceed to estimate an Ordinary Least Squares model. However, populations in adjacent areas are likely to display similar behavior, which can influence teenage fertility, and causing it to be spatially auto-correlated. A Spatial Lag model that accounts for correlation within clusters is applied to the geo-referenced Mexican Census data.

The data source is the 2010 Population Census. Women were asked about the date of birth of last child born alive. With this data, fertility rates for women aged 15 to 19 years in the previous 12 months are calculated for a 10% sample of 5.5 million of young women in 2 456 municipalities. Besides the fertility information, the Census provides data on structural conditions (education, labor, and access to health services) at the municipality level.

In the Census, missing data arise in the fertility information of young women. [4] This is more frequent at very young ages and in contexts with lower levels of education. We proceeded to impute values using a multivariate normal regression method. [5] We obtained 50 sets of possible values and replaced the missing fertility data with the average of the possible values. For the country as a whole, the teenage fertility rate raised from 61.7 births per one thousand women ages 15 to 19 before the imputation to 66.7 after the imputation process; changes in the rates were uneven between the municipalities because data quality also varies.

Municipalities greatly differ in land extension and population size. In 301 municipalities the number of women ages 15 to 19 is less than 100. In order to obtain reliable estimations, we proceeded to collapse these small municipalities with their closest neighbor and obtained 2 155 municipalities or groups of small municipalities. [6]

Concerning the explanatory factors, in order to depict the education and labor local opportunities for young women, we use three variables: the proportion of children aged 12 to 14 attending school, the proportion of salaried female workers ages 20 to 34 and the proportion of professionals and technicians among female workers ages 20 to 34.

The proportion of children aged 12 to 14 attending school is a good proxy of the available local educational opportunities. It has been shown that the existence of local school facilities in the next level favors the completion of the previous level. Therefore, this variable not only reflects school attendance to secondary school but also the probable existence of a tertiary level school nearby. As girls aged 15 to 19 should be mainly attending this tertiary level, we pose that the higher the proportion of children attending school in the municipality, the more local educational opportunities girls have and the lower the teenage fertility will be.

Young women in salaried jobs indicate the local demand for female labor, which is highly and positively correlated with better jobs -higher salaries and access to social benefits. We pose that municipalities with higher young female participation are contexts with more labor opportunities, and where maternity costs might be higher, so that young women may postpone maternity and have lower fertility.

As a proxy of the quality of jobs and access to higher education, we use the proportion of professionals and technicians among young female workers. These jobs require higher levels of qualification and may mean spaces where young women have higher income and the possibility of self development. The costs of childbearing are elevated in contexts where women professionals and technicians are relatively numerous.

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[4] 4.4% of women aged 15 to 19 years had missing values in the fertility variables.
[5] The variables used in the imputation process are age, number of children ever born, date of birth of last child born alive, number of years in school, indigenous speaking language, sibship with the household head, household size, labor force participation, if the young woman was the interviewee and the locality size.
[6] From now on, we will talk about municipalities, irrespective of them being independent or regrouped.

The sex ratio is the variable used to depict the local availability of males relative to women in reproductive ages mainly as a result of different migration patterns by sex. Teenage fertility is expected to be higher in contexts with a relative surplus of men, where finding a suitable partner will take less time.

Local access to medical services is supposed to facilitate young women use of contraceptives mainly because these services include family planning facilities thus lowering the costs of contraception. We included a access to medical services and a set of family system as independent factors in the models but because of shortage of space and time they are considered only as control variables in the models and will not be analyzed.

Results

Teenage fertility rate

As an average of the values in the municipalities, teenage fertility rate is 69.9 per thousand (table 1). [7] As expected, values greatly differ between municipalities. The first and third quartile values are 52.1 births per thousand women and 84.7, respectively. There is a case where there were no births of young women in the Census previous year while there is another where more than one in every four young women had a child.

Table 1. Descriptive statistics and Moran's I test for spatial autocorrelation for the teenage fertility rate and independent variables

|	Mean	Std Dev	Min	Max	Q1	Median	Q3	Moran's I
Dependent variable								
Teenage Fertility Rate	69.9	26.2	0.0	264.6	52.1	67.8	84.7	0.233 *
Independent variables								
School and work oportunities								
Children school attendance	89.7	5.8	35.8	100.0	86.5	90.8	94.0	0.391 *
Salaried female workers	21.1	10.6	0.2	55.1	12.7	20.8	28.8	0.590 *
Professionals and technicians among female workers	17.8	8.5	0.0	63.0	11.9	17.3	22.9	0.273 *
Marriage markets								
Sex ratio	89.8	8.6	46.6	126.0	84.5	89.5	94.9	0.561 *

Note: * p < .001 with 999 permutations.
Source: Own estimates from the 2010 National Population Census

At a first glimpse of the geographical distribution of the values of the teenage fertility rates, municipalities with higher levels predominate in the north, part of the coastal south and part of the southeast regions (Map 1). The lowest levels are concentrated in the center and a diagonal stripe towards the south. This geographical distribution does not fully correspond with what would be expected given that the northern region of the country has been characterized by its greater development and higher standards of living.

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[7] The estimate from the birth histories of 2009 national survey data (ENADID 2009) is 70 per thousand in 2006-2008.

Also the lower levels on the diagonal stripe towards the south are quite unexpected because in this region levels of development have been traditionally low. On the other hand the lower fertility rates in the central region were expected because this is the most urbanized region with the capital city in the middle.
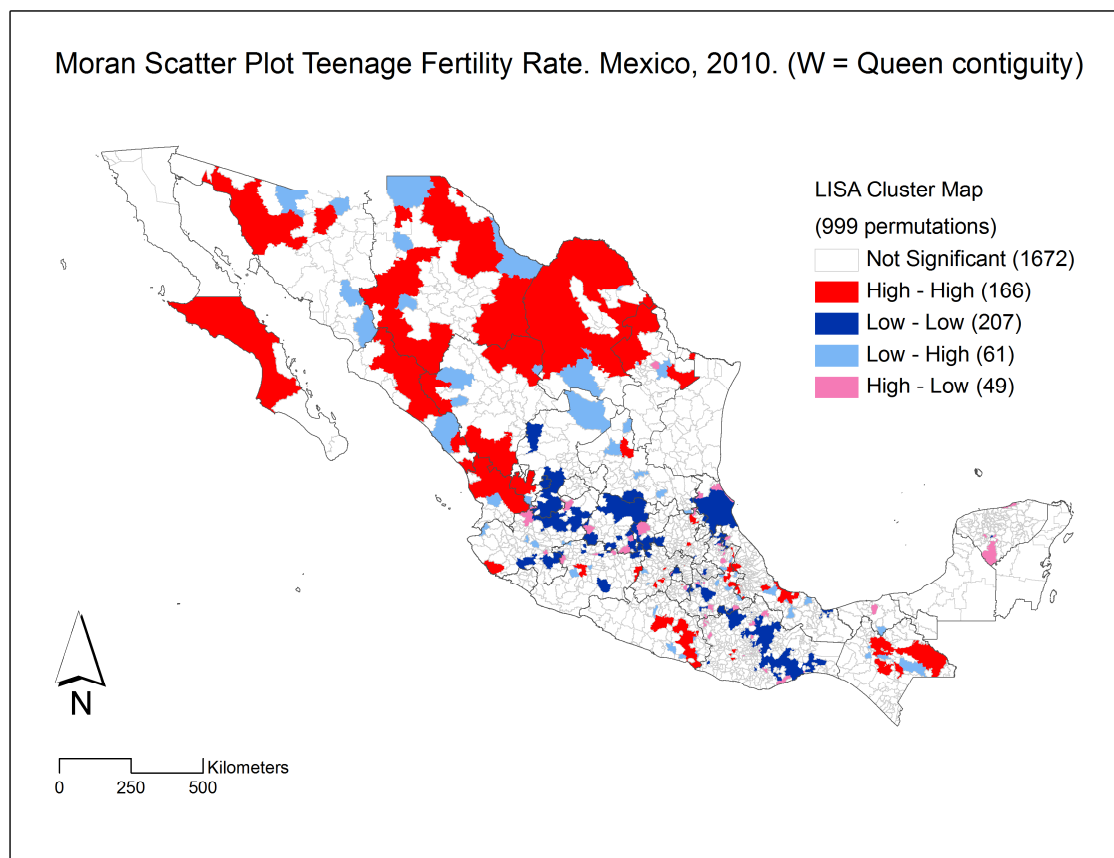
Map 1.

Teenage Fertility Rate. Mexico, 2010.
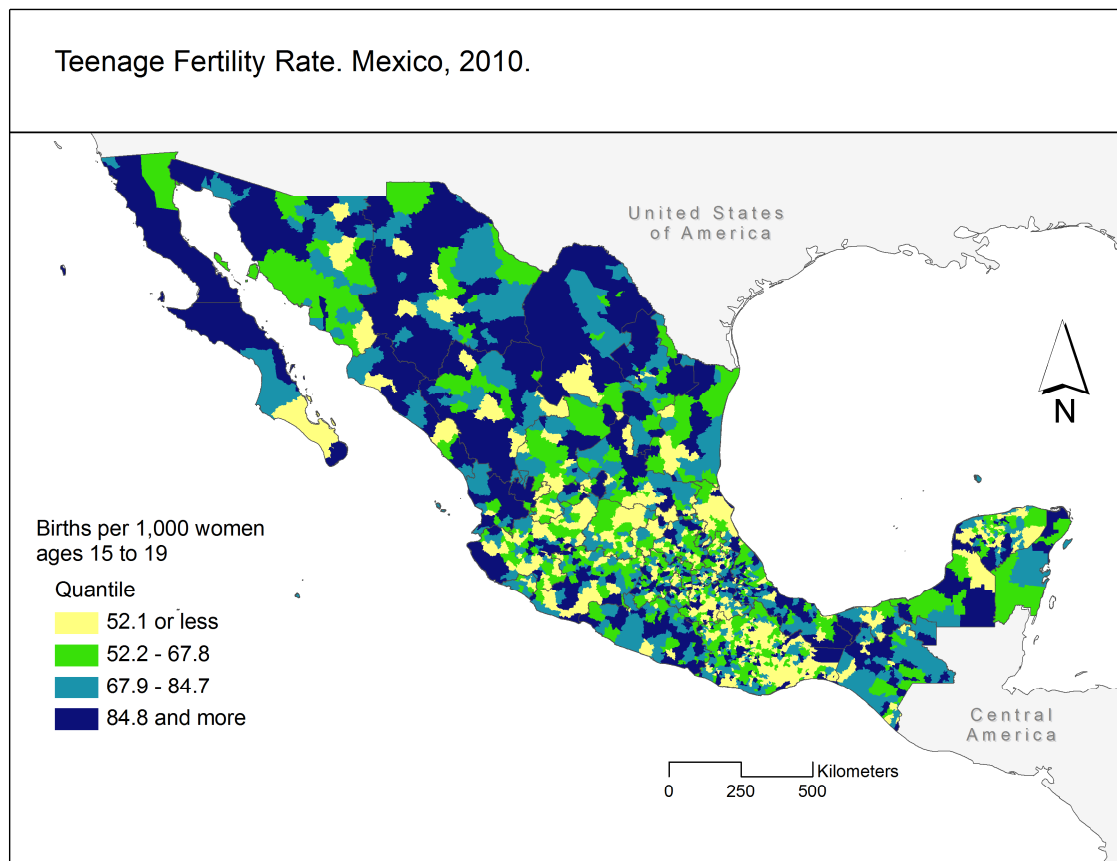
In order to assess the clustering in space of municipalities with similar teenage fertility rates, we estimated the Moran's I statistic. The positive value (0.233) and the statistical significance ($p < .001$) indicate the presence of spatial autocorrelation which means that values of the rate at a municipality are systematically related to its geographic location.

We estimated the local Moran statistic to evaluate the different types of clustering. For each municipality it indicates the extent to which the pattern of the value of the rate at that municipality and the values at neighboring ones is compatible with spatial randomness. In our case the null hypothesis is rejected because clustering of high values and low values of teenage fertility as well as local spatial outliers exist (Map 2).

Map 2.

Moran Scatter Plot Teenage Fertility Rate. Mexico, 2010. (W = Queen contiguity)

LISA Cluster Map
(999 permutations)
Not Significant (1672)
High - High (166)
Low - Low (207)
Low - High (61)
High - Low (49)

From the total number of municipalities, around 10% form part of clusters of high teenage fertility and they concentrate mainly in the northern and north-western regions. On the other hand, a slightly higher percentage, around 14% of the municipalities, cluster in groups of low teenage fertility and they are mainly located in a central horizontal strip and a diagonal towards the southeast.

It is striking that there is no low value clusters in the north or in the south-east regions. With the clusters of high values prevailing in the north, there are some (3%) outliers of low fertility, especially close to the USA border and in the western coast. Only some of these low fertility municipalities in the north correspond to big cities.

In the central and southern regions, few (2%) cases of high teenage fertility are interwoven with clusters of low fertility.

The majority of the municipalities (67%), however, do not form clusters either of high or low teenage fertility levels.

We now proceed to analyze the effect of education and work opportunities, as well as the sex ratio, on the spatial fertility patterns. We evaluate the spatial distribution of these factor variables and present the results of the statistical models.

Local education and labor opportunities

School attendance at ages 12 to 14 is widespread: in average, nine out of ten children of these ages attend school. But differences between municipalities prevail. Values of the first and third quartiles are 86.5% and 94.0%, and there is a case where only one third of the children attend school and others where all children attend (table 1).

The value and significance of the Moran´s I index suggest clustering in space of the proportion of children attending school in the municipalities. Interestingly, Map 3 shows that regions of high school attendance do not always correspond to regions of low fertility. For example, in the north where clustering of high teenage fertility exist, high values of attendance are observed.

Map 3.

Children School Attendance (ages 12 to 14). Mexico, 2010.

School attendance
Quantile
35.8% - 88.3%
88.4% - 93.0%
93.1% - 100.0%
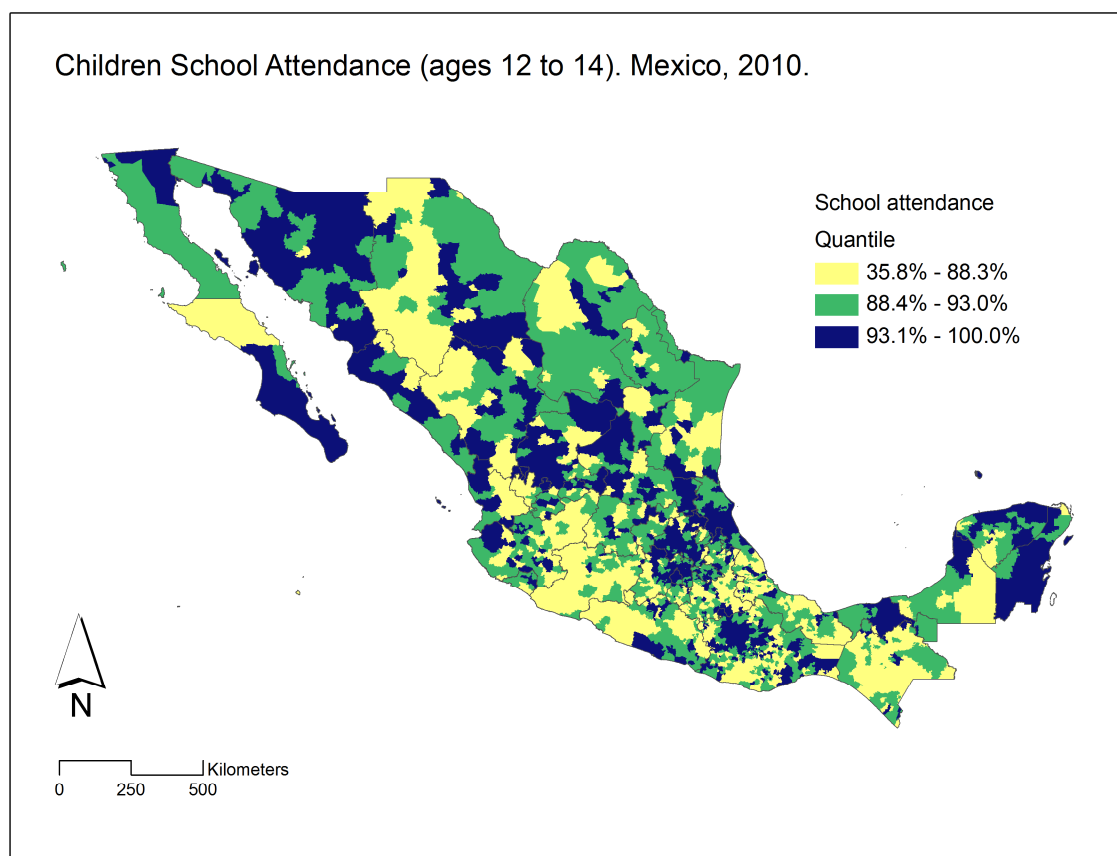
Young female participation in the labor force is relatively low in the country as a whole. In average, the participation rate of women ages 20 to 34 in the municipalities is 21.1% (table 1). For women at these childbearing ages, job opportunities are scarce in the great majority of the municipalities. However, there is a large heterogeneity. The values of the participation rate go from close to zero to more than one in every two young women, and the values of the first and third quartiles are 12.7% and 28.8%

Municipalities with similar patterns of female salaried work rate are spatially clustered, as is suggested by the high value of the Moran's I index (0.590). The higher participation rates are concentrated in the northern region -the California peninsula and the border states-, but also in the central stripe that had been identified as having lower teenage fertility (map 4). The lower female participation rates are observed in the south, characterized as less developed and with lower standards of living.
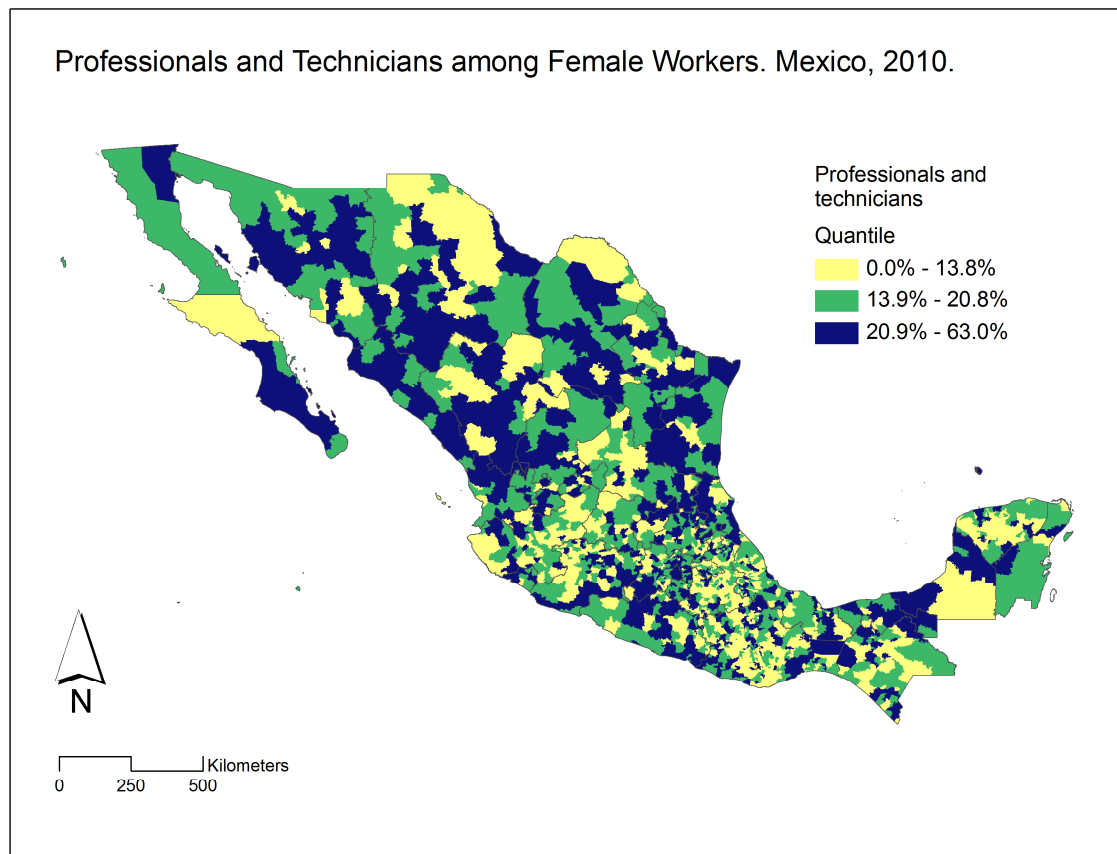
Map 4.
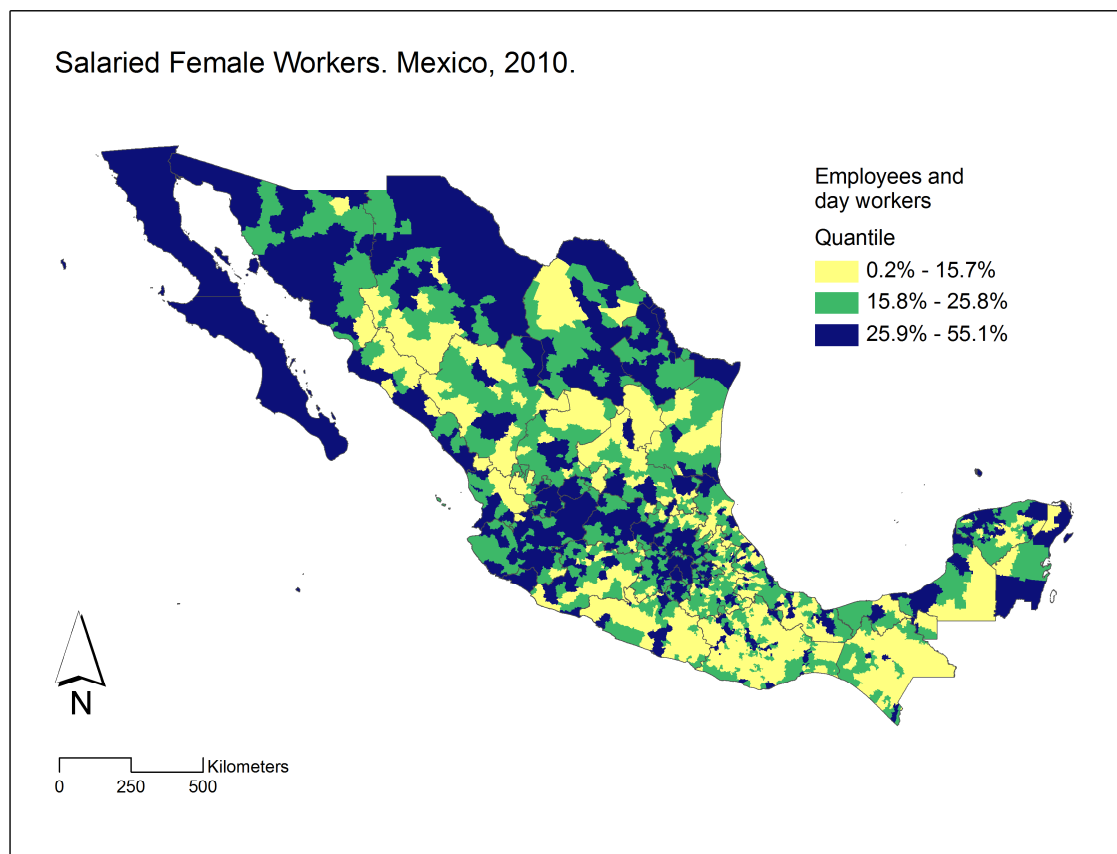
In Mexico, the type of work young female participate in is rarely qualified because precarious and low salary jobs prevail. In average only 17.8% of salaried workers are professionals and technicians (Table 1). The distribution of these more qualified jobs varies greatly between municipalities. In some, there is no young woman doing a job as professional or technician, whereas there is a case where almost two thirds of young female workers participate in these qualified jobs. The values of the quartiles are 11.9% for the first and 22.9 for the third.

Clustering in space of similar proportions of professional and technical jobs is not as strong as in the previous two explanatory factors, as shown by the values of the Moran's I index (Table 1). Spatial patterns do not clearly appear (Map 5). It should be pointed out

that high proportions of these types of jobs may be associated to high female participation rates as is the case of some cities, but also to low female participation rates in some municipalities where certain industries have settled. On the other hand, the central horizontal stripe of high female participation seams mostly related to low qualified jobs.

Map 5.

Professionals and Technicians among Female Workers. Mexico, 2010.

Professionals and technicians

Quantile

0.0% - 13.8%

13.9% - 20.8%

20.9% - 63.0%

Local marriage market

The sex ratio in the municipalities is on average 90 males for 100 females in reproductive ages (Table 1). This shortage of men relative to women greatly differs between municipalities because it is mostly associated to the emigration to the United States, and regions of origin of emigrants are clustered in space, as shown by the high value of the Moran's I index for the sex ratio (0.561). The minimum value of the ratio is less than 50, showing a strong imbalance in the population between sexes given that there is one man for each two women in reproductive ages in the municipality; the maximum value is 126. The interquartile range is not too big, given that the first quartile is 84.5 and the third

94.9. However, it becomes clear that in more than 75% of the municipalities there is a bigger or smaller scarcity of partners for women in reproductive ages.

The relative lack of men is concentrated in the central part of the country and in the south; some of these regions are the traditional providers of emigrants to the United States (Map 6). On the other hand, the northern and west coastal regions, as well as in the southeast, the sex imbalance is smaller and there is even a surplus of men; these are regions of destination of internal migration and/or not providers of international migrants.

Map 6.
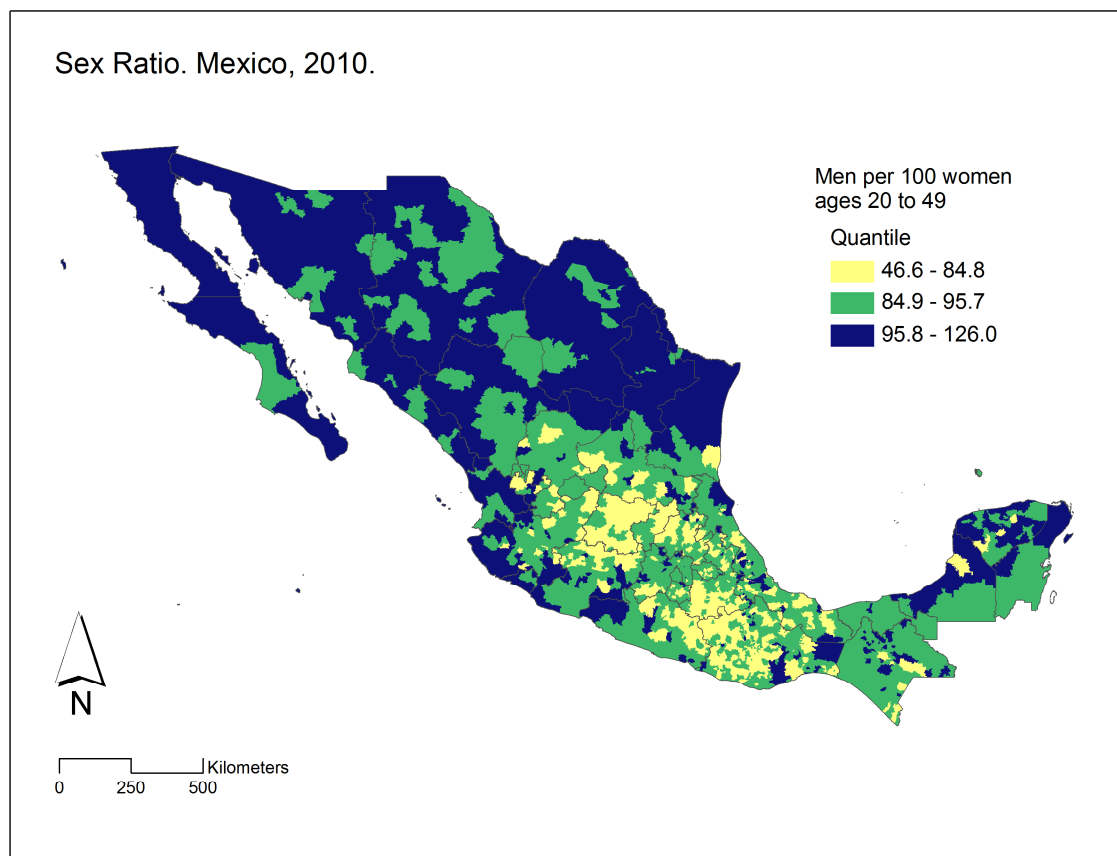
Regression results

In the Ordinary Least Squares (OLS) results, we find consistent effects for the four explanatory variables. In general these non spatial results agree with findings of studies for other units of

analysis. As expected, there is a strong negative effect of the local education opportunities on the teenage fertility rate. An increase of one standard deviation (5.8%) in children school attendance is associated to a rate decrease of 5.6 per thousand (Table 2).

The effect of the two variables of work opportunities among young women is less clear. The coefficient of the proportion of women participating in the labor force as salaried workers is not statistically significant. The proportion of young women with professional and technical jobs is statistically significant but the magnitude of the effect is limited.

On the other hand, the availability of potential male partners in the local context has a strong positive effect on teenage fertility rate. An increase of one standard deviation (8.6) in the sex ratio of the population in reproductive ages results in a rate increase of 6.3 per thousand.

Regression diagnostics reveals a lack of normality (Jarque-Bera test) and a presence of heteroscedasticity (Breusch-Pagan test) in the OLS model. Diagnostics for spatial dependence suggest the need to estimate a spatially lag model because the autocorrelation of fertility levels is not fully accounted for by the factors included in the model. [8]

In the spatial lag model there is an improvement in various aspects. The adjusted R-Squared increases from 0.198 to 0.243. The value of the Akaike information criterion diminishes, showing a better quality of the lag model for our data. The spatial lag of teenage fertility is positive and statistically significant. This finding supports the assertion that teenage fertility rates in the municipalities are influenced by the rates in other municipalities, once the other factors are controlled, consistent with the diffusion theory.

Table 2. Ordinary Least-Squares Regression and Spatial Lag Model of Teenage Fertility Rate. Mexico, 2010

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[8] The Lagrange multiplier (lag) is statistically significant while the Lagrange multiplier (error) is not.

Independent Variables	Ordinary Least Squares Regression		Spatial Lag Model	
	Estimate	t ratio	Estimate	t ratio
School and work oportunities				
Children school attendance	-5.589 ***	(-9.860)	-4.859 ***	(-8.763)
Salaried female workers	-1.350	(-1.950)	-1.413 *	(-2.103)
Professionals and technicians among female workers	-1.773 **	(-3.260)	-1.994 ***	(-3.774)
Marriage markets				
Sex ratio	6.293 ***	(10.890)	5.305 ***	(9.299)
Intercept	69.904 ***	(138.070)	51.645 ***	(25.673)
Spatial Lag (Rho)			0.262 ***	(9.367)
Adjusted R-Squared	0.198		0.243	
Akaike info criteria	19732.9		19647.6	
Regression diagnostics				
Jarque-Bera (2 DF)	1034.5 ***			
Breusch-Pagan test (9 DF)	41.9 ***		45.8 ***	
Diagnostics for spacial dependence	*Value*	*Prob.*		
Moran's I (error)	9.6	0.000		
Lagrange Multiplier (lag) (1 DF)	100.4	0.000		
Robust LM (lag) (1 DF)	12.7	0.000		
Lagrange Multiplier (error) (1 DF)	88.3	0.000		
Robust LM (error) (1 DF)	0.5	0.470		
Lagrange Multiplier (SARMA)	100.9	0.000		
N	2155		2155	

a Standardized regression coefficients and t-ratios in parentheses.
* p ≤ 0.05; ** p ≤ 0.01; and *** p ≤ 0.001
We control for three family variables: proportion of single women, cohabitation and extended families.

Also, there are interesting changes in magnitudes and statistical significance of the coefficients. In the lag model, the effect of educational opportunities slightly diminishes but remains strong. In contexts where children's school attendance is higher are likely to be contexts with more educational opportunities for young women, where they are more willing to postpone their family formation. On the opposite, in contexts where children's attendance is low, young women have quitted school at early ages and do not have alternatives outside marriage and maternity.

In the spatial lag model, salaried jobs for young women, regardless of the type of work, do exert a negative impact on the teenage fertility rate; the magnitude is small, but it is in the expected sense and statistically significant.

The effect of having increasing professional and technical jobs in the fertility rate becomes stronger in this spatial lag model. In contexts where work opportunities for young females, mainly in qualified jobs, are more frequent, the costs of childbearing are higher.

Teenage fertility levels are higher in contexts where the male population in reproductive ages is abundant relatively to females. The magnitude of the effect is big and statistically significant. An increase of a standard deviation in the sex ratio (8.6) is associated to an increase of 5.3 per

thousand in the fertility rate. The sex ratio is higher in contexts that are the destination of male internal migrants or that do not have emigration flows selected by sex. In these contexts where women are relatively scarce, they do not have to wait for a long time in order to find a suitable partner and start having children. Also, municipalities with higher sex ratios are likely to have a more dynamic economy that attracts young males, as is probably the case in the northern region. In contexts with strong male emigration flows, young women left behind will have to postpone marriage and childbearing, at least temporarily.

To conclude, we have shown the clustering in space of similar teenage fertility rates and local spatial correlation. We also showed that contexts where the education and labor opportunities are limited teenage fertility rates tend to be higher. On the contrary, the scarcity of males in the municipality, make young women postpone their fertility. This might mean more education and possibly work opportunities for single childless young women in regions of male emigration.

We expect the findings of this paper to be useful for policymakers in identifying municipalities and regions associated with higher risks of early childbirth and recognizing the modifiable influences of these patterns in order to design effective strategies to reduce teenage fertility levels.