

Effects of migration on fertility patterns of non-native women in Spain

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ABSTRACT

The aim of this study is to explore the effects of migration on fertility for foreign-born women living in Catalonia (Spain) in 2007. A common shortcoming in migrant fertility studies is the lack of information about childbearing patterns in the country of origin. One of the features that make this research particularly relevant is the opportunity to consider the whole reproductive life of migrants, i.e., before and after their arrival in the destination country.

Data come from the Catalan Demographic Survey of 2007, a retrospective survey that collects complete union and childbearing histories for both native and foreign-born women. We analyze this dataset using three methods. First, we compute age-specific fertility rates by the women's age at arrival. Second, we estimate the risk of birth as a function of the migrant's stay duration to identify the possible effects that migration movement may have on fertility patterns, both before and after the moment of arrival. Third, we use logistic regression models to analyze the risk of giving birth during the two main periods: a few years before or immediately after migration. These regression models allow us to explore the importance of socio-

demographic determinants that may help explain the general effects on fertility patterns that were observed in the second step.

Results show the existence of general patterns. There is an *interruption effect* on childbearing in the few years immediately before migration; then, there is a significant *recovery* of fertility immediately after arrival into Spain. Finally, there is a more extended effect of *adaptation* to native's behavior after several years in Spain. We also observe that variability of the above-mentioned effects is dependent on continent of origin, age at arrival, migrant motivation, birth order, or marital status at time of migration.

Keywords: foreign-born population, native population, fertility, maternal histories, Spain, Catalonia.

1. Presentation.

Migration generally occurs when people are young. Immigrants have most of their reproductive period ahead of them following their arrival in destination countries. However, early childbearing is common among non-European migrants, which usually means that many women had children previously, while in their birth countries. Immigrant fertility has traditionally analyzed births that occur in the country of destination, due to data availability. This work, however, will demonstrate that it is extremely important to study the complete reproductive biography of migrant women and consider their children born during the pre-migration period to have a better understanding of their fertility behavior. We will also show that studies must consider the age at migration.

The main aim of this work is to study the relationships between fertility and migration for foreign populations living in Spain. We recognize that migratory movements may affect reproductive behaviors, especially if they take place during the fertile age years; we also acknowledge that the fertility behaviors in the country of origin can be a factor in the migration process. To study this interaction process, we consider three aspects. First, we examine the entire migrant reproductive life; we take into account the period before, during and after the main migratory event. Second, we compare migrant behavior with native behavior to identify adaptation or convergence effects on fertility, depending on the age at arrival. Third, we consider the effect of variables like continental origin and union status at the moment of migration to address heterogeneity in demographic behaviors and detect differences and similarities between groups. Finally, we will study the factors that may explain the behaviors of women just before or just after the moment of migration.

This research will allow us to look for answers to several questions: Does the migration process affect reproductive behavior? Are the fertility effects of the migratory movement limited to the post migration period? What is the relative importance of disruption and adaption processes? How does the fertility of migrants differ by age at arrival or country of origin? The present research contributes to the literature because we consider the duration of residence at the place of destination as well as the age at migration to be key variables to study the differential behavior of migrants relative to the autochthonous population. We

intend to demonstrate that that time until the migratory movement, i.e., the fertility behavior of migrants in their place of origin, may also be an important variable.

After this introduction, the paper includes a background section describing the relevant literature, followed by a description of the dataset and methodological references. The results are divided into two sections. A first section includes a descriptive analysis that compares previous and post migration fertility levels through age specific fertility rates. A second section applies statistical analysis through the use of discrete-time logistic regression models to identify the risk of childbirth as a function of the duration before or since entry into Spain. A third section briefly describes the work that we will complete in the future, particularly the models that will allow us to further detail the fertility effects of migration on just before and just after the movement takes place. We discuss the results obtained in the last section of the paper.

2. Background

The immigrant population becomes more integrated into the host society with increasing periods of residence in destination countries (Gordon, 1964). From a reproductive behavior perspective, this assumption implies that longer post-migration periods lead to greater similarity in migrant and native fertility patterns.

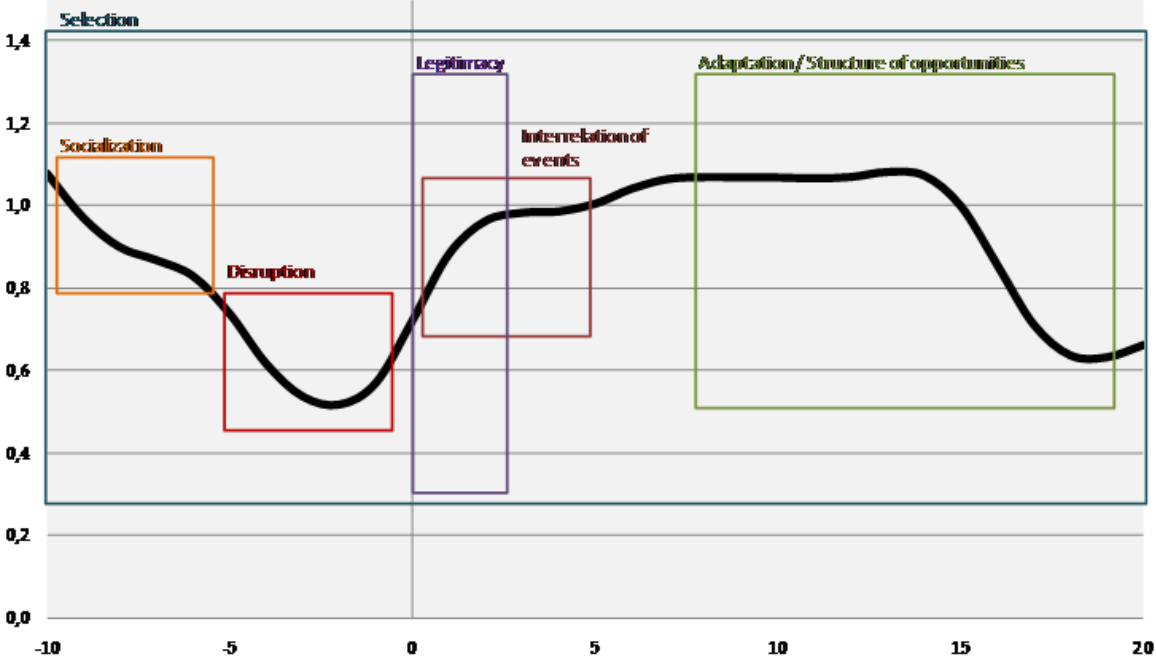
Previous literature outlined the different theoretical perspectives and explanatory hypotheses that discuss the relationship between fertility and migration (Anderson, 2001; Kulu, 2003; Lindstrom and Giorguli, 2007; Milewsky, 2007; Roig and Castro, 2007; Castro and Rosero-Bixby, *in press*). On one hand, the adaptation hypothesis has the greatest factual support for the assumption that immigrant women gradually adapt their reproductive behavior to native reproductive behavior. On the other hand, some authors defend the opportunities structure hypothesis, which explains why migrants change their fertility behavior as a consequence of their socio-demographic and economic characteristics in their destination countries (Frank and Heuveline, 2005). Milewsky (2010) and Kulu (2003) consider that both hypotheses belong to the same process, characterized by a re-socialization process and a conciliation with the social, political and labor circumstances in which the migrants live, which both lead them to adapt their fertility behavior to the social situation in the destination country. The selection

hypothesis assumes that the reproductive intentions of migrant women are originally closer to the fertility pattern in destination countries than those of sedentary women who remain in their countries of origin (Milewsky, 2007). Migrant women usually have a higher age at first union, a lower fertility level and higher labor market participation rates (Lindstrom and Giorguli, 2007). The disruption hypothesis argues that fertility falls immediately prior to migration due to the higher personal and economic costs linked to the migration process (for example, the geographic distance between spouses or the interruption of economic activity). To address a consequence of the above-mentioned interruption, some authors formulate the hypothesis of interrelation of events, which argues that a high fertility just after migration is closely linked to family reunifications or couple formation (Roig and Castro, 2007). The socialization hypothesis suggests that the first generation of migrants preserves the dominant fertility patterns of their origin countries because they usually migrate after termination of education in their country of origin (Milewsky, 2007; Kulu, 2003). This hypothesis implies that only migrants who arrive at a very young age and members of the second generation have a reproductive behavior close to the levels in the country of destination. Finally, the legitimacy hypothesis is presented as a causal relation between international migration, legal status and demographic events (births, in this case). This approach is based on the idea that undocumented immigrant women increase their fertility upon arrival in the destination country, as they intend to obtain some kind of legal or economic benefit through childbirth (Bledsoe, 2004; Bledsoe et al., 2007).

Using a longitudinal perspective, some studies from countries with a long immigrant tradition have demonstrated that the migrant fertility generally decreases immediately before and at the moment of migration, which provides evidence to support the disruption hypothesis. Fertility then increases during the first few years of residence, confirming the interrelation of events hypothesis, then decreases after a possible phase of stability after years of residence, corroborating the adaptation hypothesis (Carter, 2000; Khan, 1994; Lindstrom and Giorguli, 2007; Parrado and Morgan, 2008). In the European context, the literature primarily focuses on family reunification and couple formation processes as determinants that explain the observation of higher fertility just after migration (Anderson, 2001; Kulu, 2003; Alders, 2000; Toulemon, 2004).

In Figure 1, we depict the location of the effects described previously on the relative fertility level of immigrants before and after the migration movement. This curve, which we will later present in greater detail, measures the odds ratio of immigrant versus autochthon birthrate in relation to the duration of stay, both before and after the time of arrival (which corresponds to duration 0).

Figure 1: Location of explanatory hypothesis for the effects of migration on fertility, before or after the arrival at the place of destination.



Source: the authors. The values represent the odds ratio of immigrants versus autochthones giving birth depending on the duration of stay, controlling for age. Negative durations correspond to immigrant childbirths in the country of origin.

Previous research has focused on the complementary relationships between the three main “classical” fertility effects of migration: adaptation, disruption and selection (Kulu, 2003; Milewsky, 2007). However, most of this literature focuses on post-migration fertility behaviors, and it usually fails to consider migrant behavior in country of origin. Hence, the bulk of studies on migrant fertility concern fertility after immigration, and the main research question analyzes convergence (or adaptation) processes with the autochthonous population. This question is indeed important; however, we think that convergence is only one of the effects on fertility

because the migration movement may interrupt the reproductive life. The migration may even be the result of fertility behaviors at the place of origin. What may appear to be an adaptation process may actually be the consequence of the disruption. For example, migrants may postpone their fertility before the migratory movement and then “catch up” at the place of destination. This catching-up process may be falsely identified as an adaptation process because the fertility will fall after the recuperation phase. A lack of appropriate data hinders research efforts, and there are very few studies that analyze behaviors before and after the migratory movement. A longitudinal retrospective survey with detailed maternal history that includes both the autochthonous and the immigrant population is needed to fully study interaction effects. Our research is strongly influenced by Toulemon (2004 and 2006), who developed the methodology utilized in the present paper and applied it to foreign migrants in France. He argued that the comparison between natives and immigrants is traditionally performed using Total Fertility Rates (TFR) computed from births at the place of destination, but it is not the most suitable indicator because it does not take into account the discontinuity created in immigrant women’s reproductive cycles. TFR overestimate migrant fertility, mainly due to the catching-up effect after arrival.

3. Data and Methods

3.1. Data

The statistical source used in this paper is the Catalan Demographic Survey 2007, conducted by the Statistical Institute of Catalonia (IDESCAT). This source is rich in biographical data, especially for women. It allows us to reconstruct their union formation history and full maternal history. With this information, we can longitudinally explore the full reproductive cycle of women up to the time of survey. In 2007, immigrant women in Catalonia represented 19.6% of the total population in Spain, and 23% of the births from foreign-born mothers in Spain took place in Catalonia. Results obtained from this Catalonian survey are highly representative of the entire immigrant population in Spain. The foreign-born population represents 14% of the survey’s total sample (27,911 individuals). In our analysis, we select women aged 15 years and more, creating a final sample of 10,474 native-born women and 1,631 foreign-born women.

This data source also allows us to calculate the migrant's duration of stay before and since arrival, information that is not directly available in traditional data sources (i.e., vital statistics, census data or demographic statistics derived from the Population Registers). Although the population surveyed lives in the Catalonia region, we use "age at arrival" into Spain (not into Catalonia). The transnational migration is the most significant, and subsequent internal movements inside Spain are much less disruptive on migrant life and thus much less important. The "native" group with which we compare migrants in the rest of the study refers to women who were born in Spain and resided in Catalonia at the time of the survey.

3.2. Methods

We apply three kinds of methodology—descriptive and statistical analysis—to this dataset. First, we compute the traditional period age-specific fertility rates, taking into account the geographical origin and the age at arrival of women. We analyzed women residing in Catalonia in 2007 to calculate rates for both Spanish and foreign childbirth in the 1987-2006 time period.

As Table 1 shows, the women surveyed in the Catalan Demographic Survey had 5,998 births in the 1987-2006 time period, 1,449 of which (24%) are from foreign-born mothers. The higher number of births is from foreign-born mothers who arrived in Spain at a relatively older age; a total of 36% of the births are from women who arrived at 33 years of age or more. These women had most of their children in their country of origin. At the other extreme, 21% of the births are from women who migrated to Spain at an age equal to or younger than 23 years and had most of their children after the migratory movement. Only 43% of those births are from women who migrated in the middle of their reproductive life and gave birth to children in both their place of origin and the place of destination.

Table 1: Sample distribution by age at giving birth and origin (natives and immigrants by age at arrival), Catalonia 1987-2006.

Births										
		Age at migration								
		<i>Natives</i>	<i>Immigrants</i>	<i>0-12</i>	<i>13-17</i>	<i>18-22</i>	<i>23-27</i>	<i>28-32</i>	<i>More than</i>	<i>TOTAL</i>
				<i>years</i>	<i>years</i>	<i>years</i>	<i>years</i>	<i>years</i>	<i>33 years</i>	
Age at birth	<i>15-19</i>	76	154	4	12	28	50	48	12	230
	<i>20-24</i>	424	445	10	19	79	110	103	124	869
	<i>25-29</i>	1.432	415	16	13	48	106	78	154	1.847
	<i>30-34</i>	1.733	274	20	6	26	43	57	122	2.007
	<i>35-39</i>	743	126	7	3	8	5	20	83	869
	<i>40-44</i>	129	31	0	1	0	2	3	25	160
	<i>45-49</i>	12	4	1	0	0	0	0	3	16
	<i>TOTAL</i>	4.549	1.449	58	54	189	316	309	523	5.998

Women (15-49)										
		Age at migration								
		<i>Natives</i>	<i>Immigrants</i>	<i>0-12</i>	<i>13-17</i>	<i>18-22</i>	<i>23-27</i>	<i>28-32</i>	<i>More than</i>	<i>TOTAL</i>
				<i>years</i>	<i>years</i>	<i>years</i>	<i>years</i>	<i>years</i>	<i>33 years</i>	
Age at birth	<i>15-19</i>	15.274	4.789	310	394	1.152	1.514	957	462	20.063
	<i>20-24</i>	17.054	4.964	217	187	819	1.527	1.079	1.135	22.018
	<i>25-29</i>	18.535	4.403	177	105	355	1.037	1.094	1.635	22.938
	<i>30-34</i>	18.800	3.476	158	69	182	378	730	1.959	22.276
	<i>35-39</i>	18.352	2.545	143	61	119	157	242	1.823	20.897
	<i>40-44</i>	17.522	1.712	98	57	81	127	91	1.258	19.234
	<i>45-49</i>	15.935	1.129	64	38	56	125	55	791	17.064
	<i>TOTAL</i>	121.472	23.018	1.167	911	2.764	4.865	4.248	9.063	144.490

Source: Catalan Demographic Survey, 2007, IDESCAT. The count of women is in person-year.

Second, we calculate a statistical analysis of the risk of childbirth as a function of the duration of stay before or since the migratory movement. We use logistic regression modeling to measure the relative risk of immigrant childbearing in relation to the same risk for autochthonous women, taking into account the duration before or since entry into Spain and controlling for age. The duration variable we study can have a negative value if a birth occurs before the migration movement or a positive value if it takes place afterwards. To estimate models, the data file is turned into a person-year file, and a dummy variable is computed with value 1 indicating a birth in the current year and 0 representing no birth.

Logistic regression models were estimated according to the formula:

$$\ln \frac{p_{d,a}}{1 - p_{d,a}} = \hat{b}_0 + \sum_{d=-10}^{d=20} \hat{b}_{1,d} d + \sum_{a=15}^{a=49} \hat{b}_{2,a} a$$

Where $p_{d,a}$ is the probability of having a live birth for duration of stay d , measured as the number of years until or since migration, and at age a . The model treats both the duration and the age variables as categorical (not continuous) variables. The duration of stay d varies between -10 and 20 years for migrants. Durations less than -10 or more than 20 are regrouped with these values. For the native population, an arbitrary value is given to this duration variable (outside of the -10 to 20 range), and this value is used as the reference category in the logistic regression. In the following section, we will use the estimated values of the coefficients $b_{1,d}$ to compute the *odds ratios* for the risk of childbirth during each observed year of the stay d , in relation to native population considered as a reference, controlling for the effect of the age through the estimation of the coefficients $b_{2,a}$. Note that the duration curve graphs have been smoothed for ease of interpretation of the results¹.

These duration models are first estimated for all the women, and then we stratify the sample to view the effect of three other variables: 1) main geographical origins; 2) age at arrival of immigrants; and 3) union status at the moment of migration (in a union vs. not in a union).

Origin. We classify people according to their continent of birth, excluding Asian-Oceania people due to the small number of cases. We observe that the group of immigrant women born in American countries (mostly Latin American) is the largest, and the main African country of origin is Morocco.

¹ Fertility curves have been smoothed using the algorithm `4253H.Twice`, which forms part of Tukey's exploratory data analysis approach (Velleman, 1980).

Table 2: Sample distribution by origin, Catalonia 1987-2006.

	N	%	%
Natives	10.624	86,5%	
Immigrants	1.657	13,5%	100%
<i>Europeans</i>	511	4,2%	30,8%
<i>Africans</i>	327	2,7%	19,7%
<i>Latin-Americans</i>	739	6,0%	44,6%
<i>*Asians</i>	80	0,7%	4,8%
Total	12.281	100%	

Source: Catalan Demographic Survey, 2007, IDESCAT.

Age at arrival. The distribution of women according to their age at arrival in Spain is dominated by women who arrived during their reproductive life (62% moved to Spain between age 20 and 39 years). A total of 25% of the women arrived before or just at the beginning of their reproductive life (before 20 years of age), whereas very few arrived at its end (after 40 years of age) (see Table 3).

Table 3: Sample distribution by origin, age at arrival and union status at the moment of migration, Catalonia 1987-2006.

	Europeans		Africans		Latinamericans		TOTAL	
	N	%	N	%	N	%	N	%
Age at arrival								
0-9 years	53	10,7%	31	9,6%	31	4,3%	115	7,5%
10-19 years	89	17,9%	79	24,5%	101	14,2%	269	17,6%
20-29 years	187	37,6%	125	38,8%	284	39,8%	596	38,9%
30-39 years	107	21,5%	66	20,5%	188	26,4%	361	23,6%
40-49 years	61	12,3%	21	6,5%	109	15,3%	191	12,5%
Total	497	100%	322	100%	713	100%	1.532	100%
Union Status at moment of migration								
Not in union	238	46,6%	138	42,2%	381	51,6%	757	48,0%
In union	273	53,4%	189	57,8%	358	48,4%	820	52,0%
Total	511	100%	327	100%	739	100%	1.577	100%

Source: Catalan Demographic Survey, 2007, IDESCAT.

Union Status. Using the date of migration and the start and end dates of any marriage or consensual union, we ascertain whether immigrant women were in a

union at the moment of migration. Although total figures show a balanced distribution between both groups (48% of women are not in a union, while 52% are in a union), some differences appear when a sample is observed by origin. A total of 58% of Africans and 53% of Europeans were in a union at the time of migration, whereas only 48% of Latin American women had this status at migration.

Finally, in the final version of the paper, we will present the various implications of the work included here. The principal goal will be an effort to better understand the meaning of the two main effects detected through the previous analysis and ascertain the fertility levels of migrants just before and just after their migratory movement.

4. Fertility before and after migration

Descriptive analysis through ASFR

The results clearly suggest substantial differences in reproductive behavior when we consider the immigrant age at arrival. Following Toulemon (2004), Figure 2 presents the Age-Specific-Fertility Rates curves by immigrant women's age at arrival, based on births from 1987-2006. This is a period analysis in which we include births during the entire fertile age span, both before and after arrival in Spain. We also include a comparative curve for the autochthonous population, which refers to women who were in Spain and lived in Catalonia in 2007. We hereafter refer to this group as the 'native' women. The TFR for these women is 1.2 children per woman. Compared with natives, fertility rates for the whole immigrant population reach the same maximum level in different age groups and present strong timing differences. Their fertility level is generally high, at younger than 25 years of age. Teenagers have a very high fertility level. Immigrant women have roughly tenfold the native level at less than 20 years of age. Fertility is also slightly higher in women greater than 35 years old, which could be explained by the behavior of women who arrived to Spain at more than 25 years of age, as we will see later. The TFR value for the whole immigrant population is 1.8 children per woman.

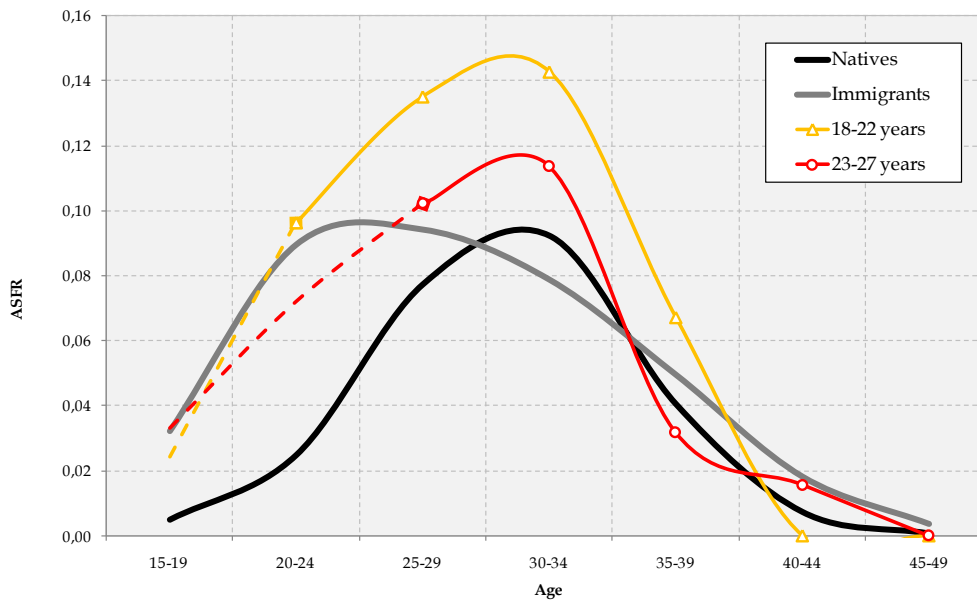
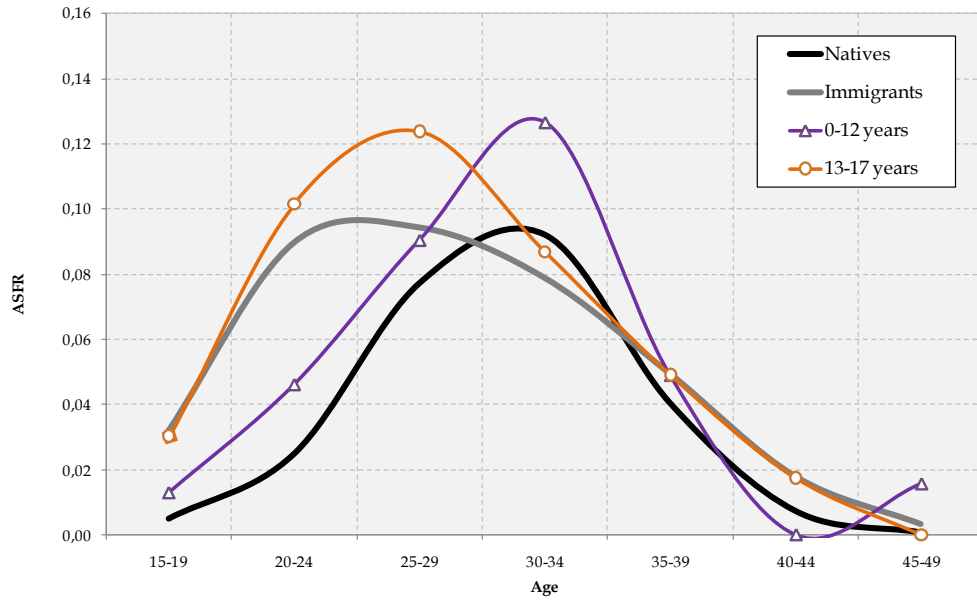
Figure 2 also shows immigrant fertility patterns by age at arrival. First, women who migrated to Spain before 12 years of age had all their children in Spain. Migration has no direct effect on their fertility, but their origin may explain the differences in fertility compared with native women. The timing of their fertility is

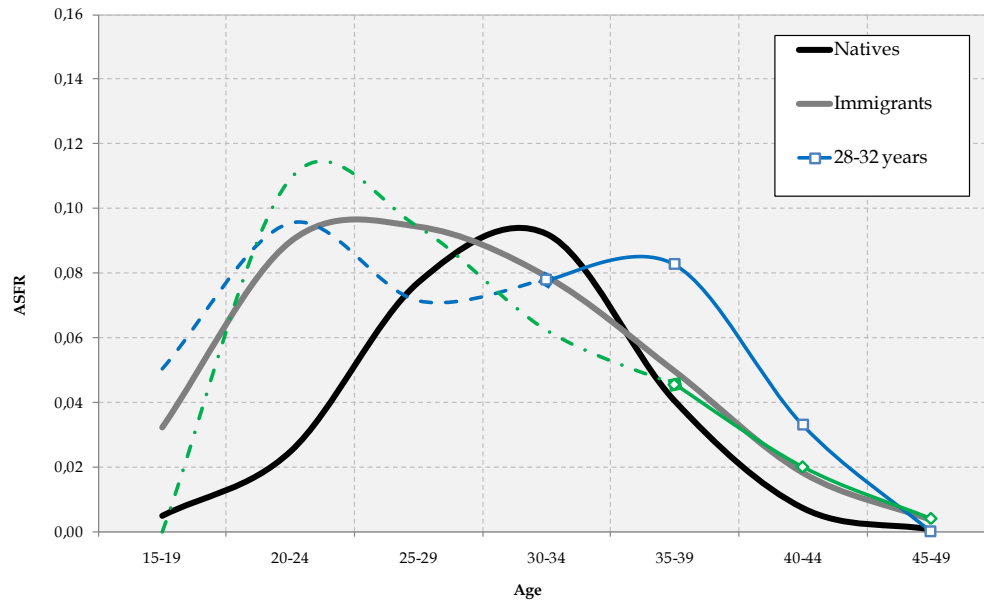
very similar to that of autochthonous women, but their actual fertility level is higher, with a TFR value of 1.73 children per woman. It is remarkable that their teenage fertility level is closer to native levels than to that of immigrants, which suggests that the fertility of these women shows important signs of an adaptation process. However, the adaptation process is seen only for the timing, not for the overall fertility level.

Second, women who migrated to Spain between age 13 and 17 years had spent most of their socializing process in their country of origin, but there is almost no effect of migration on their fertility, as their migratory movement took place just at the beginning of their reproductive cycle. It is noteworthy that the timing of their fertility is much younger than the timing of native fertility and that of migrant women who arrived before 13 years of age. For women who migrated at age 13-17, their teenage fertility level is much higher than the previous group, which is an important observation. We can say that the fertility pattern of these women is very unlike that of the autochthonous one, which may be seen as an incomplete adaptation process. Another possible explanation, if we wish to avoid the idea of a “change of behavior”, is material status. The material and non-material status of these women is probably quite different from that of women who migrated at less than 13 years of age. For instance, these women may have different education levels, labor conditions, family structure, proportions of mixed marriage, or other conditions that may explain why their fertility patterns differ from those of the youngest migrants.

The third group refers to women who arrived in Spain between 18 and 22 years of age who reached reproductive age in their country of origin. Their fertility pattern is younger than the autochthonous one, and its level much higher than migrant women who arrived at a younger age, with a TFR value of 2.3. The difference from native women is much greater than for the two previous migrant groups, and their adaptation process seems to be weaker. The fourth group corresponds to women who arrived between 23 and 27 years of age; they also spent the first part of their reproductive life in their country of origin. This group differs from the previous group because the overall fertility level before migration is much lower, which is a probable consequence of disruption due to migration.

Figure 2. Age-specific fertility rates of immigrant women by age at migration to Spain (1987-2006)





* The black curve indicates the age-specific fertility rates for women born in Spain, and the grey one indicates women born abroad. To represent immigrant women by age at arrival, the curves are in dashed lines until the age at migration. A large dot designates the point of entry, and the curves are shown in solid lines for post-entry ages.

Data Source: Catalan Demographic Survey, 2007, IDESCAT.

Finally, for women who arrived in Spain between the ages of 28-32, the fertility pattern shows a clear disruption caused by the migratory movement. These two groups present similar fertility patterns compared with other immigrant groups, characterized by early childbearing at 20-24 years old. However, after the reduction in fertility associated with the migration process, we observe a peak at later ages, caused by childbirth in the place of destination.

For the last four groups (women who migrated in their twenties or at the beginning of their thirties), we observe a kind of *controlled* behavior that implies two steps: a first phase of fertility restraint prior to migration, and a second phase of recovery almost immediately after migration. We conclude that migration definitely interferes with their reproductive cycle. It is unclear whether the migration process alters their fertility behavior, or if the succession of these two phases is a consequence of a life change that may explain both their low fertility in their country of origin and their decision to migrate. For example, problems with the labor market may have forced these women to decrease their fertility and

instigated their decision to migrate. Their higher fertility level in the destination country may either be then a consequence of their previous low fertility or may be due to the improvement of their economic situation. This catching-up process may be symbolic; childbirth in destination countries may be seen as a sign of settlement or integration. One final possible explanation for the lower fertility before and the higher fertility after migration is asymmetric family migration. If the men migrate before the women, then the family separation and reunification process may explain this fertility curve fluctuation.

A focus on these last four groups helps us understand why computation of the TFR for immigrant women's childbirths in the place of destination can lead to an overestimation of the true level of their total fertility. The migration process is associated with anticipation and disruption processes that manifest themselves as a lower fertility level before and during the migratory movement. This system is followed by a catching-up process that takes place after the migration. Migrant women tend to have a higher than usual fertility at their place of destination to compensate for their lower fertility at their place of origin.

Modeling duration of stay before or since migration

In the second stage of our analysis, we use statistical modeling of duration of stay before or since migration to further explore the difference in fertility patterns between native and non-native women. Our hypothesis suggests that these differences can be better understood if we consider the age at arrival and the country of origin. As previously explained, we compute the relative odds of childbirth depending on duration of stay before or since entry into Spain in a comparison between immigrant women and autochthonous women, controlling for age. We also stratify our sample to look at the differences in the relative odds for three variables: age at migration, geographical origin and union status at time of migration.

Figure 3 presents the odds ratios for the fertility by duration of stay before or since migration for all of the immigrant women, relative to native women and controlling for age. Because all of the women are grouped, those who arrived at a very young age have their children at a duration of stay longer than 10 years, and those who arrived at a later age have children at negative and positive durations. The comparison is made based on the odds of childbirth as a function of the duration of stay for migrants in relation to the odds of childbirth for women born

in Spain, controlling for age. The curve for the whole group of immigrants clearly shows the presence of three main effects, which correspond to the three main components of our theoretical hypothesis:

First, there is a strong *interruption effect* (disruption hypothesis), as the odds ratios fall under the relative level of one before the migratory movement. Fertility falls during the years prior to migration, which implies a delay of childbearing in the reproductive cycle of these women. In this case, we assume that there is an effective fertility control prior to the migration process; earlier than 5 years before migration, fertility levels in their countries of origin were higher than native fertility in Catalonia, whereas the level in the 5 years prior to migration falls below one. At least two possible explanations account for this behavior. On one hand, it is possible that women plan their emigration and wait until arrival in the destination country to have the children that they would have in their origin country had they not migrated. On the other hand, another plausible explanation is that these women experienced declining family and material conditions, which led to reduced fertility and the decision to migrate. The model we use at this stage does not allow us to decide which explanation is correct.

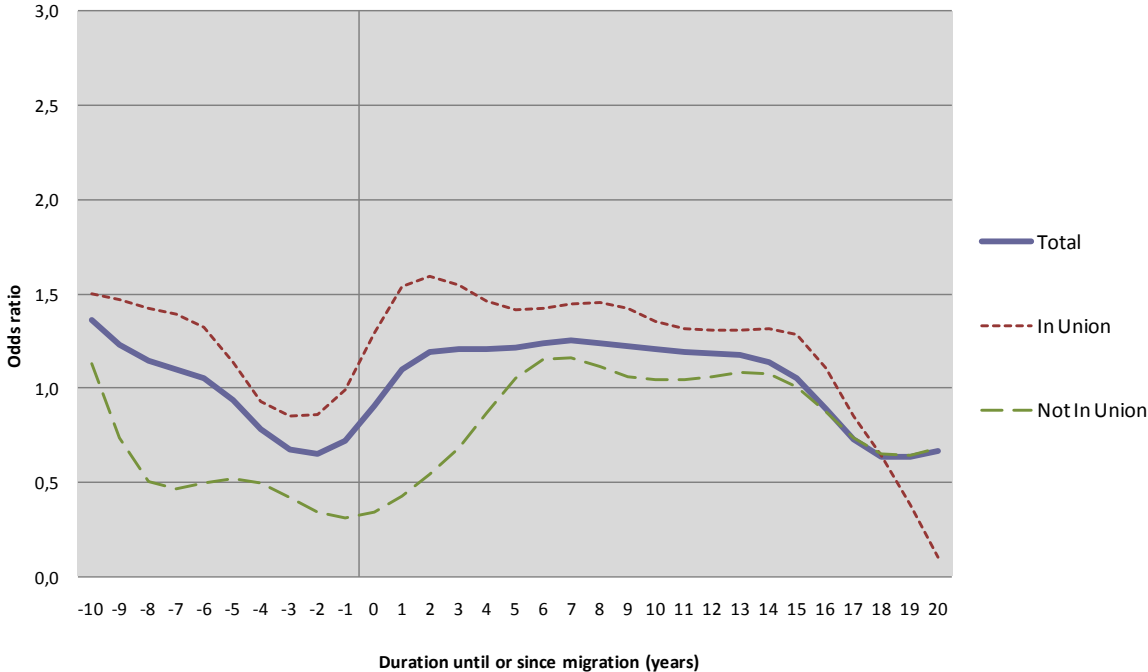
Second, we observe a clear pattern of recuperation or *arrival effect* after the migration movement, similar to the hypothesis of interrelation of events. This effect shows as an increase in the relative risk of childbirth in the first few years in Spain. One plausible interpretation is that this effect represents the catching-up process after the delay or interruption of fertility during the previous years, but it could also be related to family reunification processes or new couple formation. Afterwards, the relative level remains stable until 15 years after migration, and it is quite difficult to separate the catching-up effect from the convergence or adaptation effect.

Third, the fertility curve for all of the migrant women shows a *convergence effect* from the adaptation hypothesis because their fertility levels progressively approach the native fertility level as years of residence in destination countries increase.

To improve our explanation of these effects, we stratify our sample to separate the migrant women according to their union status at time of migration: whether they were currently in a union (married or cohabiting) or not in a union. As Figure 3 demonstrates, there are strong differences between these two groups. In women who were in a union at the time of migration, we observe the presence of a

stronger and shorter anticipatory effect than for women not in a union. We also note a higher recuperation effect and a faster adaptation effect that is appreciable from the downward trend for relative fertility levels beginning at duration 3, although their fertility level is quite high compared with the native fertility until 16 or more years of residence. For women who were not in a union at the time of migration, we observe almost no anticipatory effect, and the recuperation effect takes place much later, after 5 years of residence or more. Their fertility is higher than native women only after this time period. For women who were not in a union, we can assume that most of them need time to initiate new relationships and have their first child, which may explain why their fertility is initially low after arrival. It is interesting to note that this difference in recuperation effect timing explains why the adaptation effect is almost nonexistent for all women.

Figure 3. Immigrants' fertility by duration since migration and by union status at time of migration, relative to native level, controlling for age.

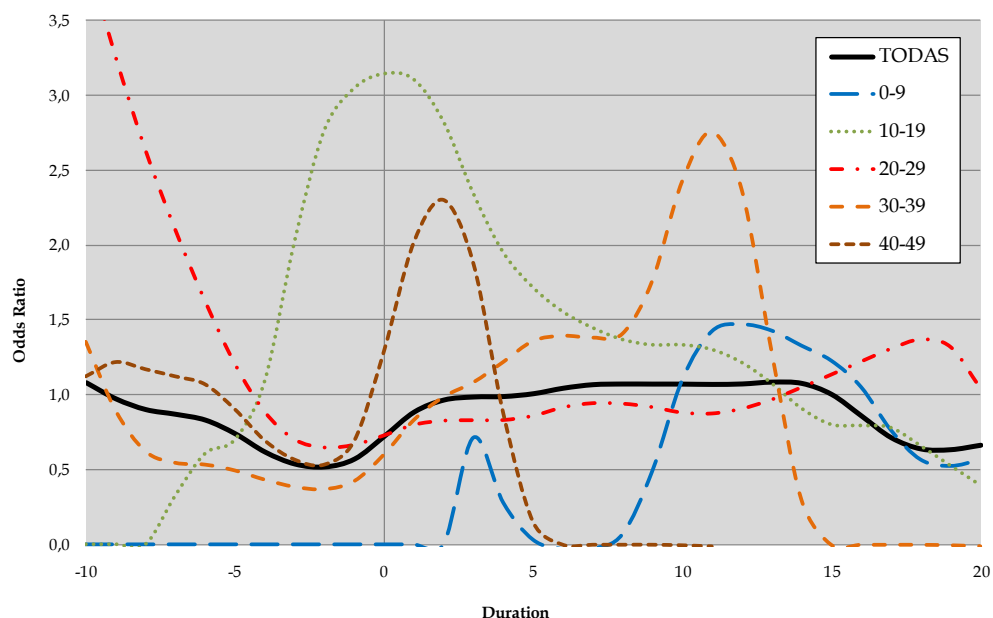


* The duration curves are smoothed using the 4235H.Twice algorithm of Velleman (1980)

Data Source: Catalan Demographic Survey, 2007, IDESCAT.

Further analysis demonstrates that the pattern of disruption is clearer if we examine similar curves for women at distinct migration ages (Figure 4). For women who arrived between ages 0 and 9 years old, the reproductive age span begins after duration 10. The bulge around duration 12 represents that their fertility took place at a younger age than native women, whereas the peak for duration 4 is probably due to data inconsistencies. For women who arrived between ages 10 and 19, we observe that their fertility was very high before and just after the migratory movement. This finding can be interpreted by a reverse causation effect: the migration may have been a consequence of teenage births in the country of origin or even a pregnancy with a delivery in Spain. These situations would represent another interpretation of the interaction between fertility and migration, with the latter being a consequence of the former. These women do not present the anticipation effect because they are just at the beginning of their reproductive life. There is no recuperation effect, as the migration movement coincides with the birth. For women who arrived between 20 and 29 years of age, we observed early timing of childbirth, with a very high teenage fertility typical of the fertility pattern of their country of origin. We observed anticipatory behavior in the 5 years preceding migration. However, when the recuperation effect is weak and takes place after 10 years of residence, if ever, their fertility level is close to native fertility. One possible explanation for this weak recuperation effect is the existence of offspring in their country of origin. These women are seeking jobs after their arrival, so they are probably controlling their fertility during their first years of residence until they achieve some economic stability. This behavior may explain why there is a recuperation of fertility after 10 years of residence. Second marriages, new relationships or family reunification could impact fertility after 10 years. For women who arrived between ages 30 and 39, there is a strong and long anticipatory effect that begins approximately 8 years prior to migration. For this group, lower levels of fertility before migration may not be due to anticipation behaviors; these women may already have all the children that they wanted, which could also explain their weak immediate recuperation effect. Finally, for women who arrived at age between 40 and 49 years, we note very strong anticipatory and recuperation effects. This last effect is partially a consequence of arrival in the last years of their fertile age span.

Figure 4. Immigrants' fertility by duration since migration and by age at arrival, relative to native level, controlling for age.



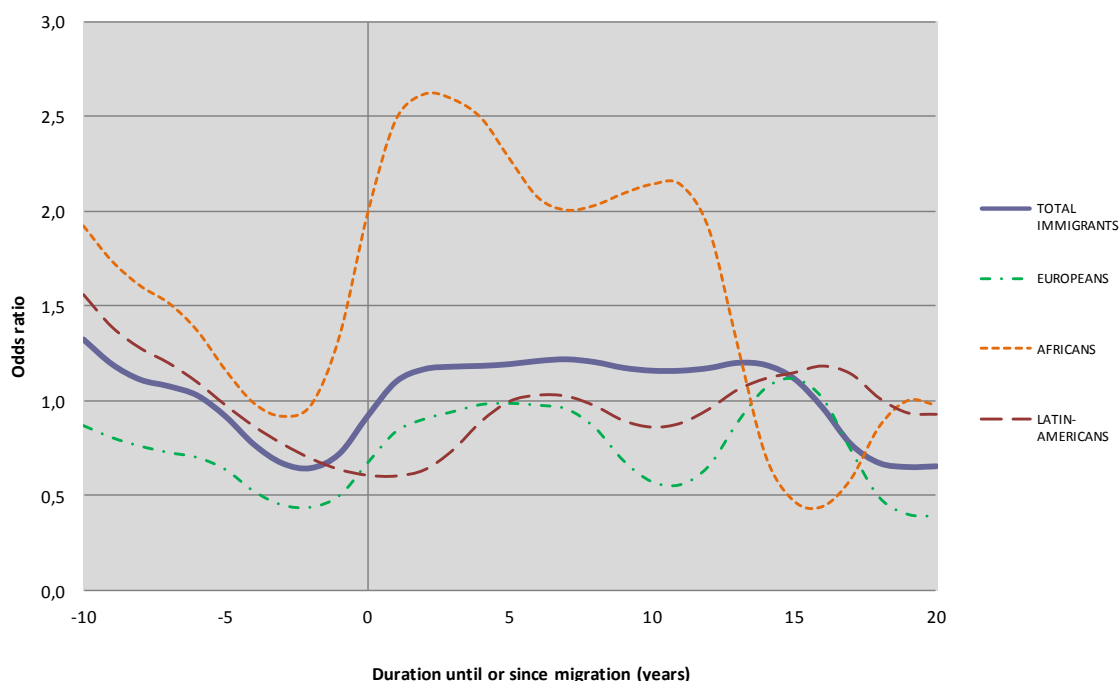
* The duration curves are smoothed using the 4235H.Twice algorithm of Velleman (1980)

Data Source: Catalan Demographic Survey, 2007, IDESCAT.

An analysis of the geographical origin of immigrant women (Figure 5) outlines interesting differences. For women born in European or Latin American countries, the pattern of effects is similar, with a level of fertility close to that of Spanish women. Nonetheless, there are differences between these three groups of migrants. In the case of **Latin-American** women, the disruption of their reproductive life seems to be highest; the recuperation effect takes place later, after 3-4 years of residence. Recuperation in this group is the weakest among the three groups of immigrants. This longer interruption may be explained by the fact that this immigration is predominantly feminine. Most of these women immigrate alone, leaving spouses and family in the country of origin. They may be single at the time of the migration and need time to initiate new relationships. A characteristic of this group is the progressive increase in fertility with increasing years of residence. The increase is at a level close to autochthonous women. In contrast, **European** women are the only group with lower fertility levels than native women. Their anticipation

effect is weaker and the recuperation effect is intense only after 2 to 7 years of residence. We should remember that most of the European population is similar to Spain, with low or very low fertility levels compared with other regions of the world. Women born in **African** countries have much higher fertility levels than the other two origin groups before and after migration. Their higher overall fertility explains why the anticipation effect seems to be less pronounced, and the recuperation effect seems to be the strongest of the three groups of immigrants. The lowest value of the odds ratio for duration -3 and the highest value for duration 3 are well above the corresponding values for the other two groups. We also observe the presence of a strong convergent (or adaptive) effect, as there is a downward trend in the curve beginning at duration 3. The African migration to Spain usually consists of men who arrive alone and later reunify with their spouses. The arrival of African women is primarily instigated by family reunification rather than labor reasons. This situation may explain why the relative level of fertility just after arrival in Spain is so high. Although the economic and personal costs of migration are high, the added legal, social and economic benefits of childbirth in Spain may also explain why their fertility is relatively high in the first 5 years following arrival.

Figure 5. Immigrants' fertility by duration since migration and by origin, relative to native level, controlling for age.



* The duration curves are smoothed using the 4235H.Twice algorithm of Velleman (1980)

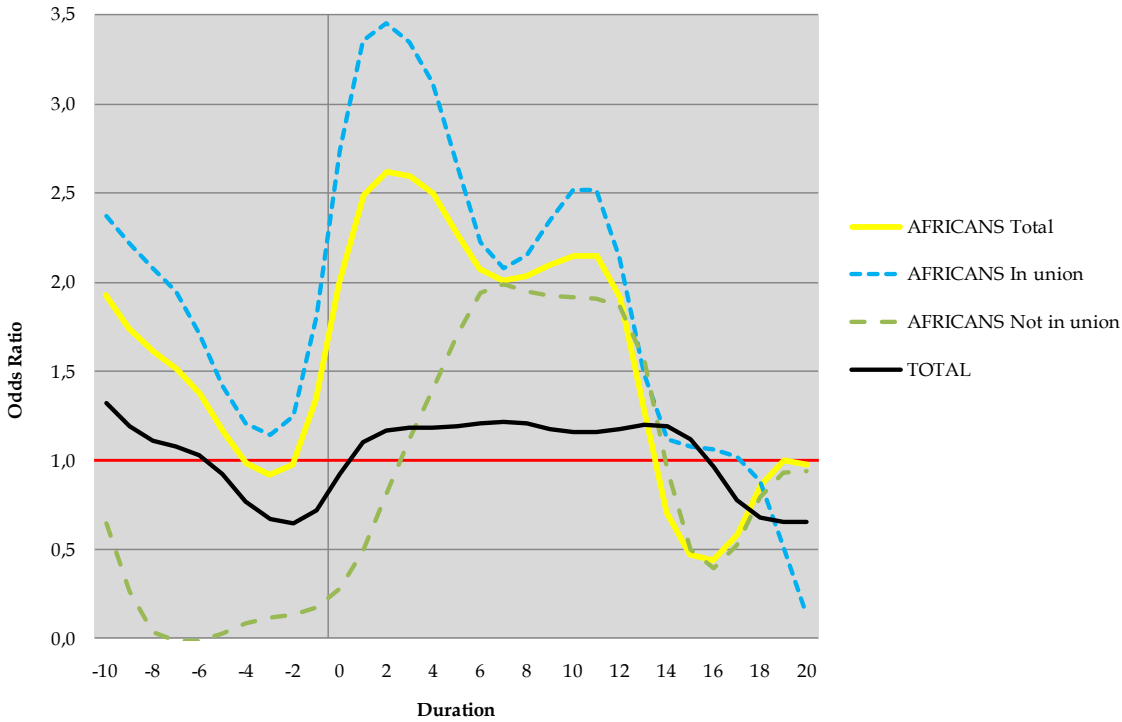
Data Source: Catalan Demographic Survey, 2007, IDESCAT.

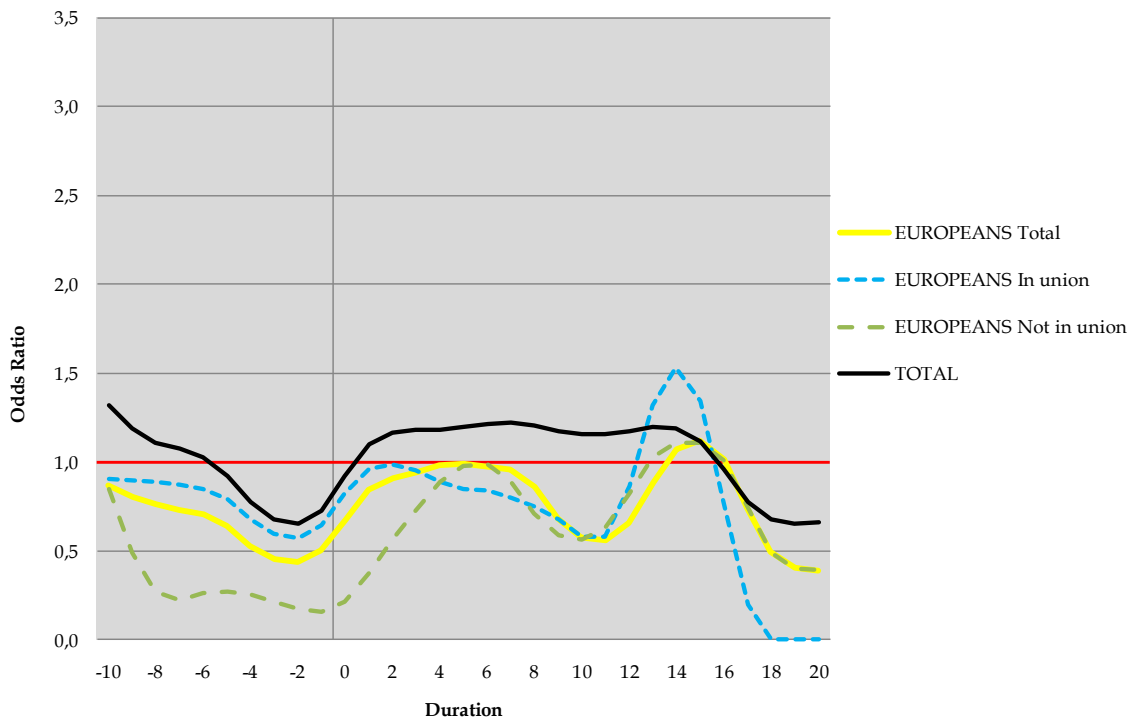
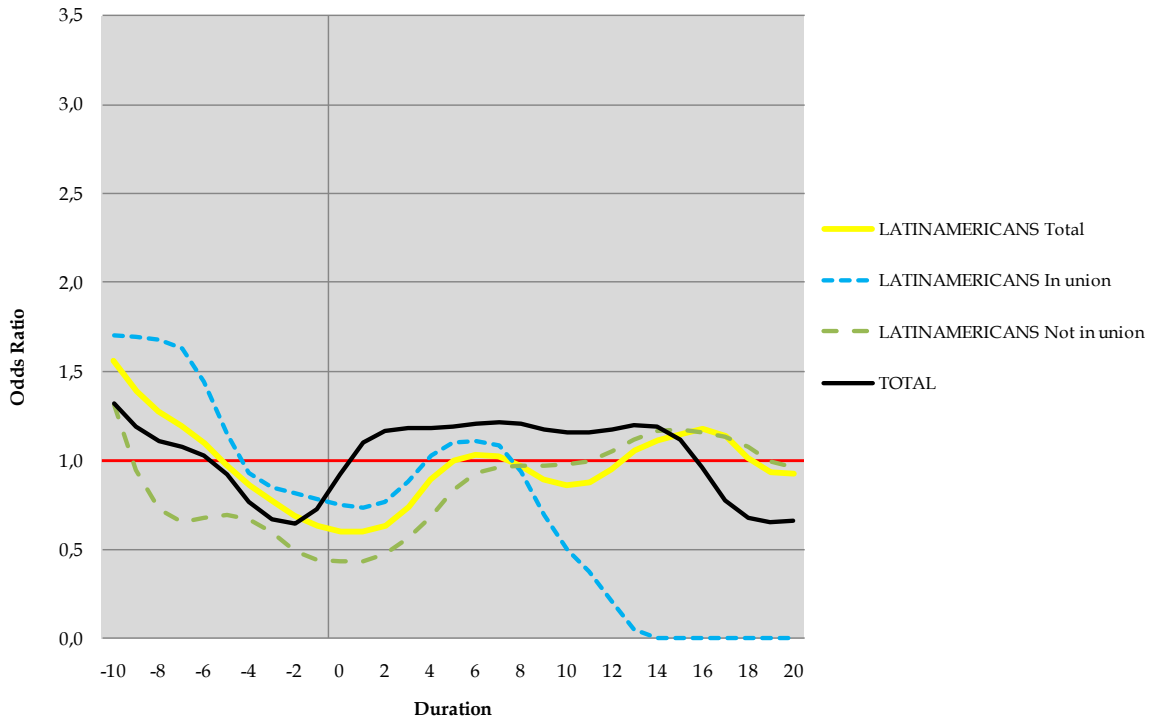
If we observe the same data by origin and consider the union status at time of migration (Figure 6), we observe that African women have the largest differences between women who have migrated while in a union or not in a union, whereas there are less differences between the women who migrated from a European or a Latin American country. Generally speaking, as previously shown in Figure 5, there is almost no anticipatory effect, and the recuperation effect takes place much later, at a duration of 5 years or more, for women not in a union. The recuperation effect is the strongest, and the adaptive process is much clearer, for women in a union at time of migration compared with the curves for all women.

In the case of Latin American women, we observe that the relative fertility level of women in a union or not in a union at time of migration is closer between them before and after migration and is closer to the native level as well. This group is

less impacted by migration discontinuity. The recuperation effect for women in a union takes place later than for European or African women, probably because the Latin American women tend to leave their partners or husbands in their country of origin. This may explain why the recuperation effect is so weak in this group. The disruption effect of migration may lead to an overall lower fertility level compared with women who did not migrate.

Figure 6. Immigrants' fertility by duration since migration, by union status at the moment of migration and by origin, relative to native level, controlling for age.





* The duration curves are smoothed using the 4235H.Twice algorithm of Velleman (1980)

Data Source: Catalan Demographic Survey, 2007, IDESCAT.

5. Extensions to the analysis that will be included in the final version of the paper

In the previous section, we identified the fertility interruption effect that takes place a few years before migration, and the recuperation effect seen just after migration. We will investigate the potential causes of these effects. As previously discussed, the drop in migrant fertility level just prior to movement may be due to a couple's anticipatory behavior to postpone births. Thus, the subsequent increase may be associated with recuperation behaviors. This alternation between reduced and increased fertility may also be the consequence of a time delay between the migration of the husband and his wife, which could correspond to a family reunification effect. Another possible and opposing explanation could be that the drop in fertility at the place of origin is the consequence of socio-economic problems that may also explain the decision to migrate. In that sense, the subsequent increase in fertility may be caused by a relative improvement in economic situation in the place of destination. To determine which of those explanations is the more plausible, we will model fertility just before and just after the migratory movement and will use correlates such as the motive of the migration, the education level and other socio-economic variables.

We will also include other extensions that may shed light on the nature of the effects of migration on fertility:

1. Application of the methodology used to estimate the risk of childbirth as a function of the duration of stay. Comparison of the curves showing the risk of forming a union for migrants, before or after the move, with the curves showing the risk of fertility may aid in understanding the dynamics of delay and recuperation.
2. Application of the same methodology for the risk of childbirth, taking into account the birth order. A consideration of the patterns of effects of migration on first births may also help in discriminating between the alternative hypotheses previously outlined.

3. Another question we want to address is the issue of testing the significance of the coefficients that measure the effect of duration of stay (until or since migration) on fertility. We will determine whether the duration coefficients are significantly different from 1, i.e., whether the fertility level is different from autochthonous women. The models we use are non-parametric because we include a coefficient for each single age and for each single duration. The coefficients are too numerous, and almost none are significantly different from 1 in the statistical sense. At the moment, we are exploring parametric modeling: fitting the duration curves by mathematical functions with 3 or more parameters and testing the significance of each of these parameters. One promising methodology we plan to explore is the use of fractional polynomials (Royston and Sauerbrei, 2009).

6. Discussion

This paper explores the effects of the migration process and the length of stay in Spain on the fertility behavior of migrant women, analyzing the shape of their fertility curves by duration. We found several instances of the effects of migration on fertility. First, we identified an intermediate stage of immersion in the cultural and economic context of the host society for women who arrived before 13 years of age and grew up in Spain. The timing of their fertility patterns does not differ from that of natives, but their slightly higher intensity may be the consequence of a socialization process occurring in between the two contexts. Because the migration itself did not disrupt their fertility, we consider that immigrant origin may affect their behavior. A second group of women who arrived as teenagers differs from the previous group in the earliest timing of their fertility. This finding may illustrate both the effects of age at arrival, as these women spent their childhood in their country of origin, and the duration of stay, because they gave birth after fewer years of residence than the previous group, on fertility and other associated behaviors.

Third, we saw how women who arrived in their twenties divided their fertility between the places of origin and destination. These women had children at early ages, as was expected from the general pattern of timing for immigrant women. Upon arrival in Spain, some spread out their fertility, whereas others subsequently increased their fertility. In both instances, their intensity of post-migration fertility

levels is closer to the native fertility. Additionally, the closer their age is to thirty at migration, the higher the disruption in their reproductive life.

The fourth pattern described women who arrived in Spain after 30 years of age. These women had spent most of their fertile years in their country of origin. As a result of migration, they experienced a fertility recovery at a late stage of their reproductive life, either through family reunification or new unions. We note that the greater their age at migration, the less time they wait to have a baby in Spain. We suggest that the impending end of their fecund period determined that duration.

In short, we have seen that depending on the stage of their reproductive life cycle when the women migrate, the magnitude of the effects changes. We can identify in the fertility curves several effects common to all, albeit with a greater or lesser degree depending on the age at migration. The *anticipation effect* is widespread and consists of a control and a delay of fertility during the 4-5 years prior to emigration. Only women who migrated as children or as teenagers do not experience this effect, for obvious reasons. The curves for teenage immigrants show what could be called a *causal effect*, which links migration to fertility. Women who delay their maternity in the years before migration later experience an *arrival effect* that is characterized by a high level of fertility in the early years of residence. This arrival effect is probably closely linked to family reunification. However, among those who migrated in their twenties and thirties, the arrival effect expands in time. After a period of more than 8 years of residence, the effect intensifies in what might be termed an *installation effect* that includes time necessary for social inclusion and new conjugal relationships. Finally, we conclude that after a post-migration period of high fertility, there is a *convergence or adaptation effect* for young immigrant women. The convergence among those who migrated in the older age group is caused by the end of the childbearing years. It is also important to remember that what may appear to be an adaptation process may only be the consequence of an interruption effect; if migrants postpone their fertility before the migratory movement and then catch up at the place of destination, the catching-up process may be falsely identified as an adaptation process.

Beyond the general profile of migrant women, there are also notable differences by origin. African women have the greatest differential behavior compared with native and other migrant women. Due to their high fertility level, the anticipation effect is the weakest, and the arrival effect is the sharpest. African immigrant

women are largely women who arrive in Spain either as spouses or who get married immediately after arrival. Their labor insertion is lower than other non-native groups. If we add the conditions of high fertility in their country of origin and the added value of social guarantees following childbirth in Spain, it is not surprising that these women contribute significantly to Spanish fertility.

Although the sex ratio of African immigrants to Spain is characterized by an excess of men who tend to arrive alone and later regroup with their wives, Latin American flows have been traditionally more feminized. This difference may explain why their transition to post-migratory motherhood requires a longer period of residence in Spain, because they either need time for family or union reunification or they need to form a new conjugal relationship if they were single at the time of migration. Europeans have reproductive patterns closer to those of the native population, which is consistent with the common patterns of countries characterized by low fertility rates similar to Spain. Moreover, the absence of legal impediments and free movement within Europe might explain why European fertility is not as sensitive to the effects of migration.

Our longitudinal data analysis presents a more accurate view of migrant fertility compared with previous Spanish research. The duration model developed in this work constitutes an exploratory approach to study fertility patterns in a life cycle perspective. However, it would be interesting to expand this research topic. First, it could be important to investigate which factors or specific determinants (demographic, economic or cultural) influence each of the observed effects. Future research may consider how elements such as religion, educational level, occupation or the number of pre-existing live children relate to migrant fertility decisions, as well as the role of institutional context over causes and patterns of fertility behavior. Another useful extension would be to conduct the same kind of analysis for men, research that we regrettably have been unable to do with our survey tool because it does not include full paternal history.

In this paper, we have presented a preliminary analysis. We would like to further pursue this research and expand on the extensions outlined in section 5.

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