Age at Migration and Fertility Patterns in Spain: Differences by Origin and Length of Stay

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Abstract - This is a study of interactions between fertility and migration for foreign populations living in the Spanish region of Catalonia in year 2007. By interactions we understand not only the effects of the migratory movements on reproductive behaviors, but also that the fertility behaviors at place of origin can be a factor of the migration process. In order to study these interactions, we choose to consider all the reproductive life of migrants, which means before and after the main migratory event. We use a retrospective survey with complete maternal histories, for both native-born and born abroad women. We compute age specific fertility rate and duration of stay specific risk of birth. Analysis takes into account age at migration, continent of origin and union status at time of migration. Results show four different migration effects on fertility: causal effect and disruption effect as pre-migratory effects; and arrival effect and adaptation effect as post-migratory effects.

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

Generally, migration occurs when people are young. Hence, immigrants still have most of their reproductive period ahead after arriving in destination countries. However, an early timing to childbearing is common among non-European migrants, which usually means that many women had previous children in their countries of birth. Traditionally immigrant’s fertility has been studied from births that occur in the country of destination, due to data availability. But as we will show in this work, it is extremely important to study the complete reproductive biography of migrants women, that is, to take into account the children born during the pre-migration period, in order to have a better understanding of their fertility behavior. We will also show that another important element in the study of the interaction between fertility and migration is to consider the moment in the life cycle when the movement takes place, in other words, 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. By interactions we understand not only the fact that the migratory movements may affect reproductive behaviors, especially if they take place during the fertile age years; but also that the fertility behaviors at place of origin can be a factor of the migration process. In order to study this interaction process, we use three points of view. Firstly, we consider the whole reproductive life of migrants, which means that we take into account the period before, during and after the main migratory event. Secondly, we compare migrants' behavior to native one in order to identify adaptation or convergence effects, depending on the age at arrival. And finally, we consider the effect of variables like the continental origin and union status at the moment of migration in order to deal with heterogeneity in demographic behaviors and to detect differences and similarities between groups.

This research will allow us to look for answers to several questions: Does the migration process affect the reproductive behavior? Are the effects of the migratory movement on fertility limited to the post migration period? What is the relative importance of the disruption and the adaption processes? How different is fertility of migrants by age at arrival, or by origin? In this sense, the present contribution to the topic of study has the added value of considering the duration of residence at the place of destination as well as the age at migration, as key variables for studying differential behavior of migrants relative to autochthonous population. But we intend to show that time until the migratory movement 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. Results
are divided into two sections. A first section includes a descriptive analysis, which 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 having a child at each duration until or since entry into Spain. A conclusion section ends the paper.

2. Background

The longer the period of residence in destination countries, the more integrated into the host societies is the immigrant population (Gordon, 1964). From a reproductive behavior perspective this assumption would mean that the longer the post-migration period is, the closer the fertility patterns of migrants and natives are.

Previous literature has widely outlined the different theoretical perspectives and explanatory hypothesis about 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 is the one with the greatest factual support for the assumption that immigrant women gradually adapt their reproductive behavior to natives' one. On the other hand, some authors defend the opportunities structure hypothesis, which explain why migrants change their fertility behavior as a consequence of the socio-demographic and economic characteristics they have in the destination countries (Frank and Heuveline, 2005). In this sense, Milewsky (2010) and Kulu (2003) consider that both hypothesis belong to the same process, characterized by some kind of 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 the immigrants experiment in the destination country. Another type of explanations is related to the hypothesis of selection for migrant population which assumes that reproductive intentions of migrant women are originally closer to the fertility pattern in destination countries than the one of sedentary women who remains in 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 presents another kind of explanation, based on the idea that fertility falls in the immediate period previous to migration due to the higher personal and economic costs linked to the migration process (for example the geographic distance between spouses, the interruption of the economic activity). Usually as a consequence of the above-mentioned interruption, some authors formulate the hypothesis of interrelation of events, which consider 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 keep the dominant fertility patterns from their origin countries
because they usually migrate after the end of schooling in their country of origin (Milewsky, 2007; Kulu, 2003). This leads to the expectation 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 when arriving to the destination countries, as they intend this way to obtain some kind of legal or economic benefit (Bledsoe, 2004; Bledsoe et.al, 2007).

Using a longitudinal perspective, some studies from countries with a long immigrant tradition has proved how, in general, fertility of migrants decrease at the moment of migration and in the period immediately before –proving the disruption hypothesis-, then increase during the first few years of residence –confirming the interrelation of events hypothesis- and fall down after a possible phase of stability during the following years of residence –corroborating the adaptation hypothesis- (Carter, 2000; Khan, 1994; Lindstrom and Giorguli, 2007; Parrado and Morgan, 2008). For the European context, the literature has mostly focused on family reunification and couple formation processes as determinants that explain why we observe a higher fertility just after the migration movement (Anderson, 2001; Kulu, 2003; Alders, 2000; Toulemon, 2004).

Figure 1: Explanatory hypothesis in the study of migration and fertility.

Source: the authors
In summary, previous research has focused on the complementary relationships between the three main “classical” effects of migration on fertility and other behaviors: adaptation, disruption and selection (Kulu, 2003; Milewsky, 2007). However, most of this literature focus on post-migration fertility behaviors, and usually does not take into account migrants’ behaviors at their place of origin. Hence, the bulk of studies on fertility of migrants are concerned by what happen after the arrival to the place of destination, and the main research question asked is whether there is a convergence (or adaptation) process with the autochthonous population. Indeed this question is important, but we think that convergence is only one of the effects of migration on fertility for migrant populations: the migration may interrupt the reproductive life and the migration may be the result of fertility behaviors at place of origin. In this sense, what may appear as an adaptation process may be only the consequence of the disruption: for example if migrants 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. But the main reason why there are very few studies which take into account behaviors before and after the migratory movement is the lack of appropriate data source: a longitudinal retrospective survey with detailed maternal history that includes both the autochthonous and the immigrant population is needed for fully studying those interaction effects. In that sense our research is strongly influenced by Toulemon (2004 and 2006) who developed the methodology we use in the present paper and applied it to foreign migrants in France. He argued that the comparison between natives and immigrants is traditionally done using Total Fertility Rates (TFR) computed from births at the place of destination, but that this is not the more suitable indicator for doing so, because it does not take into account the discontinuity that migration suppose in the reproductive cycle of immigrant women, and in that way ends up overestimating migrant’s fertility, due to the catching-up effect after the 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, but only for women: it allows us to reconstruct their union formation history as well as their full maternal history. This permits us to explore from a longitudinal perspective the full reproductive cycle of women up to the time of survey. In 2007, immigrant women in Catalonia represented 19.6% of the total for Spain, and 23% of the births from foreign-born mothers in Spain took place in Catalonia. So results obtained
from this Catalonian survey are highly representative of the entire immigrant population in Spain. Foreign-born population represents 14% of survey’s total sample (27,911 individuals). In our analysis we select women aged 15 years and more, for a final sample of 10,474 native-born women and 1,631 foreign-born women.

This data source also allows us to calculate duration of stay of migrants until and since arrival, something that is not available in traditional data sources (i.e. Vital Statistics, Census data or demographic statistics derived from the Population Registers). Although the population surveyed is living in Catalonia region, we use “age at arrival” into Spain (not into Catalonias) considering that the significant migration is the transnational one and that subsequent internal movements inside Spain are much less important, because they have a smaller disruptive effect on the life of migrants. Also, the “native” group to which we compare migrants in the rest of the study refers to women born in Spain and residing in Catalonia at the time of the survey.

3.2. Methods

We apply two kinds of methodology –descriptive and statistical analysis- to this dataset. Firstly, we compute the traditional period age specific fertility rates, taking into account the geographical origin and the age at arrival of women. We calculate these rates for births in the 1987-2006 time period, and which occurred either in Spain or in the countries of origin of women residing in Catalonia in year 2007.

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 high age (36% of the births are from women who arrived at 33 years or more). These women had most of their children in their country of origin. At the other extreme, a fifth part of the births (21%) are from women who migrated to Spain at an age equal or inferior to 23 years, and so had most of their children after the migratory movement. So only 43% of those births are from women who migrated in the middle of their reproductive life, and who had their children both in the place of origin and the place of destination.
Table 1: Sample distribution by age at birth and origin (natives and immigrants by age at arrival), Catalonia 1987-2006.

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

Secondly, we do a statistical analysis of duration of stay until or since the migratory movement. We use logistic regression modeling in order to measure the relative risk of childbearing for immigrant women, in relation to the same risk for autochthonous women, taking into account duration until or since entry into Spain for immigrants, and controlling for age. Therefore 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 after. The data file is turned into a person-year file. A dummy variable is computed with value 1 if there is a birth in the current year and 0 if not.

Logistic regression models were estimated according to the formula:

\[
\ln \left( \frac{p_{d,a}}{1 - p_{d,a}} \right) = \hat{\beta}_0 + \sum_{d=10}^{\text{d-10}} \hat{\beta}_1 d + \sum_{a=15}^{a-15} \hat{\beta}_2 a
\]
Where $p_{d,a}$ is the probability of having a live birth at duration of stay $d$, measured as the number of years until or since migration, and at age $a$. Both the duration and the age variables are treated in the model as categorical (not continuous) variables. The duration of stay $d$ varies between -10 and 20 years for migrants. Durations inferior to -10 or superior to 20 are regrouped with these values. We assign an arbitrary value of this duration (out of the -10 to 20 range) for the native population and select this value as the reference category in the logistic regression. In the following, we will use the estimated values of the coefficients $\beta_{1,d}$ to compute the odds ratios for the risk of having a birth 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 $\beta_{2,a}$. Note that in the graphs the duration curves we present have been smoothed in order to ease the interpretation of the results.

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

**Origin.** We classify people according to their continent of births, excluding Asian-Oceania people due to the small numbers of cases. We can observe than the group of immigrant women born in American countries (mostly Latin American) is the largest one; for women born in African countries the main country origin is Morocco.

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

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natives</td>
<td>10,624</td>
<td>86,5%</td>
<td></td>
</tr>
<tr>
<td>Immigrants</td>
<td>1,657</td>
<td>13,5%</td>
<td>100%</td>
</tr>
<tr>
<td>Europeans</td>
<td>511</td>
<td>4,2%</td>
<td>30,8%</td>
</tr>
<tr>
<td>Africans</td>
<td>327</td>
<td>2,7%</td>
<td>19,7%</td>
</tr>
<tr>
<td>Americans</td>
<td>739</td>
<td>6,0%</td>
<td>44,6%</td>
</tr>
<tr>
<td>*Asians</td>
<td>80</td>
<td>0,7%</td>
<td>4,8%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12,281</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

**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). 25% of the women arrived before or just at the beginning of

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1 Fertility curves have been smoothed using the algorithm 4253H.Twice which forms part Tukey's exploratory data analysis approach (Velleman, 1980).
their reproductive life (before 20 years of age) and very few 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.

<table>
<thead>
<tr>
<th>Age at arrival</th>
<th>Europeans N %</th>
<th>Africans N %</th>
<th>Latinamericans N %</th>
<th>TOTAL N %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-9 years</td>
<td>53 10,7%</td>
<td>31 9,6%</td>
<td>31 4,3%</td>
<td>115 7,5%</td>
</tr>
<tr>
<td>10-19 years</td>
<td>89 17,9%</td>
<td>79 24,5%</td>
<td>101 14,2%</td>
<td>269 17,6%</td>
</tr>
<tr>
<td>20-29 years</td>
<td>187 37,6%</td>
<td>125 38,8%</td>
<td>284 39,8%</td>
<td>596 38,9%</td>
</tr>
<tr>
<td>30-39 years</td>
<td>107 21,5%</td>
<td>66 20,5%</td>
<td>188 26,4%</td>
<td>361 23,6%</td>
</tr>
<tr>
<td>40-49 years</td>
<td>61 12,3%</td>
<td>21 6,5%</td>
<td>109 15,3%</td>
<td>191 12,5%</td>
</tr>
<tr>
<td>Total</td>
<td>497 100%</td>
<td>322 100%</td>
<td>713 100%</td>
<td>1532 100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Union Status at moment of migration</th>
<th>Europeans N %</th>
<th>Africans N %</th>
<th>Latinamericans N %</th>
<th>TOTAL N %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not in union</td>
<td>238 46,6%</td>
<td>138 42,2%</td>
<td>381 51,6%</td>
<td>757 48,0%</td>
</tr>
<tr>
<td>In union</td>
<td>273 53,4%</td>
<td>189 57,8%</td>
<td>358 48,4%</td>
<td>820 52,0%</td>
</tr>
<tr>
<td>Total</td>
<td>511 100%</td>
<td>327 100%</td>
<td>739 100%</td>
<td>1577 100%</td>
</tr>
</tbody>
</table>

Source: Catalan Demographic Survey, 2007, IDESCAT.

Union Status. Using the date of migration and the dates of beginning and end of any marriage or consensual union, it’s possible to know whether immigrant women were or not in union at the moment of migration. Although total figures show a balanced distribution between both groups (48% of women are not in union and 52% left are in union), some differences appear when sample is observed by origin, Africans in 58% and Europeans in 53% of the cases were in union at migration time, while only 48% of Latin-American women has this status at migration.

4. Fertility before and after migration

Descriptive analysis through ASFR

Results clearly suggest important differences in reproductive behavior when we take into account the age at arrival of immigrant women. Following Toulemon (2004), we present in Figure 2 curves of Age-Specific-Fertility Rates by age at arrival for immigrant women, based on births for the period 1987-2006. It is a period analysis in which we take into account births during all the fertile age span of women, which means before and after their arrival in Spain. We also include for comparison sake the curve for the autochthonous population, which refers to women born in Spain and living in Catalonia in year 2007. In
the following we refer to this group as the 'natives' women. The TFR for these women is 1.2 children per women. Comparing with natives, fertility age rates for the whole immigrant population reach the same maximum level, but presents strong differences in timing. Their fertility level is generally higher at less than 25 years of age, with a very high level for teenagers (immigrants women have roughly tenfold the natives level at less than 20 years). Fertility is also slightly higher at more 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 women.

Figure 2 also shows immigrants' fertility patterns by age at arrival. Women whose age at entry into Spain was less than 12 years have had all their children in Spain, which means that migration has no direct effect on their fertility, but their origin may explain the differences in fertility for native women. The timing of their fertility is very similar to autochthonous women one, but their actual level is higher, with a TFR value of 1.73 children per women. It is remarkable that their teenage fertility level is closer to native levels than to immigrants ones, which suggests that the fertility of these women shows important signs of an adaptation process, but only for the timing, not for the overall level.

Secondly, 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 interaction between migration and fertility, as their migratory movement took place just at the beginning of their reproductive cycle. It is remarkable that the timing of their fertility is much younger than the natives one and also than the timing for migrant women who arrived before 13 years of age. In that sense, an important observation is that their teenage fertility level is much higher than the one of the two previous groups. So we can say that the fertility pattern of these women is very distant from the autochthonous one, which may be seen as an incomplete adaptation process. Another possible explanation, if we want to avoid the idea of a “change of behavior”, is that material and non-material status of these women is probably quite different of than the one of women who migrated at less than 13 years old. For instance, these women may be different in their education level, in their labor conditions, their family structure, or their proportion of mixed marriage, etc., conditions that may explain why their fertility pattern is different to the youngest migrant’s one.

The third group refers to women who arrived in Spain at an age between 18 and 22 years and whose fertility before that age took place 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 distance with native women is much higher than for the two previous migrant groups, and their adaptation process seems to be weaker. The fourth group corresponds to women who arrived when
they were between 23 and 27 years old. They are also women who spent the first part of their reproductive life in their country of origin, but what differs in relation to the previous group is that the overall level before the migratory movement is much lower, which is a probable consequence of the disruption process due precisely to the migratory movement.

Figure 2. Age-specific fertility rates of immigrant women by age at migration to Spain (1987-2006)
The black curve shows the age-specific fertility rates for women born in Spain, and the grey one for women born abroad. For immigrant women by age at arrival, the curves are in dashed lines until the age at migration. A large dot represents the point of entry and afterwards the curves are in solid lines for post-entry ages.

**Data Source: Catalan Demographic Survey, 2007, IDESCAT.**

Finally, for women who arrived in Spain at age 28-32 and at more than 33 years, their fertility pattern again clearly shows the disruption caused by the migratory movement. These two groups present the same overall fertility patterns than the other immigrants groups, characterized by an early timing to childbearing at 20-24 years old. But after the reduction in fertility associated with the migration process, we observe a peak at later ages, for births 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, which implies two steps: a first phase of restrain of fertility prior to migration, and a second one, of recovery almost immediately after. We can say that migration totally interferes with the reproductive cycle of these women. But again it is not clear whether the migration process alters their fertility behavior, or if the succession of these two phases is a consequence of a change in the life of these women that may explain both their low fertility in their country of origin and why they decided to migrate. For example problems with the labor market may force these women to lower their fertility and may explain their decision to migrate. Their higher fertility level in the destination country may be then a consequence of their previous low fertility or may be due to the improvement of their economic situation. Another possible explanation for this catching-up process is that having a child in destination countries may
be seen as a sign of settlement or integration. Finally another possible explanation for the whole process, both for the lower fertility before, and the higher fertility after migration, is the existence of some delay in migration between men and women for couples: if the men migrates first and the women later, then the family separation and reunification process may explain this fluctuation in the fertility curve.

If we focus on these last four groups, we can understand why computing the TFR for immigrant women from births in the place of destination can lead to an overestimation of the true level of their total fertility: the migration process is associated with an anticipation and a disruption processes which manifest themselves as a lower fertility level before and during the migratory movement. This is followed by a catching-up process, which takes place after the migration. So migrant women tend to have a higher fertility than usual at their place of destination, as a compensation effect for their lower fertility at their place of origin.

If we look at the same data but by geographical origin, we observe that fertility of women who arrived at a younger ages is similar for those who were born in a European country, but the distance is higher for women born in an African country and curiously higher for women born in an American country. For this last origin group, we observed that teenage fertility levels is similar to the native women one, but the whole pattern is a bit younger and the overall level is quite higher than for natives. For women who arrived at around age 20, we observe again that their fertility pattern does not seem to be disrupted by the migratory movement. Again there are strong differences by origin. The fertility curve for women born in an African country is the farthest from the native’s one. We observe also than teenage fertility levels for women born in an American country are the highest. For women who arrived at around age 30, we already noted that their reproductive life was highly disrupted by the migration process. We observe the presence for the general curve (all the immigrants) of an anticipation effect before the migration, then a recuperation effect afterward. But the pattern of this disruption is quite different by origin. The disruption seems to be the strongest for natives of a European country with a strong anticipation effect and the weakest and latest recuperation effect. The recuperation effect is the quickest for natives of an African country.
Source: Catalan Demographic Survey, 2007, IDESCAT.

Modeling of duration of stay after or since migration

In a second stage of our analysis we use statistical modeling of duration of stay until or since migration, as a way to explore further the difference in fertility patterns between
native and non-native women under the hypothesis that these differences can be explained by age at migration and origin. As we explained before, we compute the relative odds of having a birth for each duration of stay until or since entry into Spain, for immigrant women in relation to autochthonous one, controlling for age. We also stratify our sample in order to look at the differences in the relative odds for three variables: age at migration, geographical origin and union status at time of migration. To compute the duration models we transform the database in a person-year file. The dependent variable is a dummy variable “birth” which has value of “1” if there is a birth during the year and takes a value of “0” if not. The variable “duration until or since migration” has a negative value if a birth occurs before migration and a positive value if it occurs afterward. The duration “0” corresponds to the year of the migratory movement. The relative odds are estimated using logistic regression.

Figure 4 presents the odds ratio for the fertility by duration until or since migration for all the immigrant women, relative to natives one and controlling for age. Since, all the women are grouped, those who arrived at a very young age have their children at duration above 10 years, and those who arrived at a later age have children at negative and positive durations. The comparison is made in terms of the odds of having a child at each duration for migrants in relation to the odds of having a child for women born in Spain, controlling for age. The curve for the whole group of immigrant shows in a clear way the presence of 3 main effects, which match with the 3 of the main theoretical hypothesis:

First, there is a strong anticipation effect (disruption hypothesis), as the odds ratios fall under the relative level of one before the migratory movement. That means that fertility fall 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 in prevision of the migration process: up to 5 years before migration, fertility levels in the countries of origin were higher than native’s one in Catalonia, while in the 5 years prior to the movement this level falls under one. Again there are at least two possible explanations for this behavior. On one hand, it is possible that women plan their emigration and wait until after arriving to the destination country to have the children than they would have in their origin country if they had not migrated. On the other hand, another plausible explanation is that women who experiment a worsening in their familiar and material conditions, which leads to a fall of their fertility and to the decision of migrate. The model we use doesn't allow us to decide which explanation is the correct one.

Second, we observe also a clear pattern of recuperation or arrival effect after migration (hypothesis of interrelation of events). This effect shows as an increase in the relative risk of having a child just in the first few years upon arrival. Again a plausible interpretation is that this is the catching up process after the delay or interruption of fertility during the previous years, and this could be related to family reunification processes or the formation
of new couples. Afterwards, the relative level remains stable up to duration 15, in such a way that it is quite difficult to separate the catching-up effect from the convergence or adaptation effect.

Third, fertility curves show an adaptation effect (adaptation hypothesis) in the way that their fertility levels are approaching progressively to the native’s one as years of residence in destination countries goes on.

In order to improve our explanation of the effects described before, we stratify our sample separating the migrant women according to their union status at time of migration: whether they are currently in union (married or cohabiting) or not. As we can see from Figure 4, there are strong differences between these two groups. For women who were in union at time of migration, we observe the presence of a weaker and shorter anticipatory effect than for women not in union, as well as a higher recuperation effect and a faster adaptation one, which is appreciable from the downward trend for relative fertility levels beginning at duration 3, although their fertility level is quite higher that native’s one until after 16 years of residence. In the case of women who were not in union at 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 being higher than native’s one only after this moment. For that last group of women, we can assume that most of them need time to initiate new relationships and to have their first child, which may explain why their fertility is low during the first years after their arrival. It is interesting to highlight that this difference in the timing of the recuperation effect between the two groups of women is the explanation why the adaptive effect is almost inexisten in the curve for all women.
Figure 4. Immigrants’ fertility by duration since migration and by union status at time of migration, relative to natives’ level, controlling for age.

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

Data Source: Catalan Demographic Survey, 2007, IDESCAT.

Going further in the analysis, the pattern of disruption is clearer if we take a look at the same kind of curves for women at distinct age at migration (Figure 5). For women who arrived between age 0 and 9 years old, the reproductive age span begin at duration 10. The bulge around duration 12 is due to the fact that their fertility took place at a younger age than native women, whereas the peak at duration 4 is probably due to data inconsistencies. For women who arrived between age 10 and 19, we observe that their fertility was very high before and just after the migratory movement. This 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 the new of a pregnancy, with a delivery in Spain. This case would represent the other way around of the interaction between fertility and migration, being the second a consequence of the first and not the opposite. For them there is no anticipation because they are just at the beginning of their reproductive life, and there is no recuperation one either, as the migration movement coincides in time with the birth. For women whose age at entry was between 20 and 29 years old, we observed that they have their children according to the early timing, with a very high teenage
fertility typical of the fertility pattern of their country of origin. We observed also the anticipatory behavior in the 5 years preceding migration. However, in their case the recuperation effect is weak (and if it takes place, it's only after 10 years of residence) and their fertility level is close to the native’s one. One possible explanation for that weak recuperation effect is that these women had offsprings in their country of origin, and are looking for job after their arrive, so they are probably controlling their fertility during the first years of residence until they achieve some economic stability, which may explains why there is recuperation of fertility around 10 years after migration, due to second marriages, new relationships or family reunification. For women who arrived between age 30 and 39 years, again there is a strong and long anticipatory effect (beginning around 8 years previous to migration), although in this case it is possible that the lower level of fertility before migrating is not due to anticipation behaviors, but because they already have all children that they wanted, which could also explain why they have a weak immediate recuperation effect. Finally, for women who arrived at age between 40 and 49 years, we note a very strong anticipatory and recuperation effects. This last effect is in part the consequence of the fact that they are arriving in the last years of their fertile age span.

**Figure 5. Immigrants’ fertility by duration since migration and by age at arrival, relative to natives’ level, controlling for age.**

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

*Data Source: Catalan Demographic Survey, 2007, IDESCAT.*
Taking into account geographical origin of immigrant women (Figure 6) we can observe more interesting differences. For women born in European or Latin American countries, the pattern of effects is similar, with a level of fertility close to Spanish women one. 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) and is the weakest of the three groups of immigrants. This longer interruption may be explained by the fact that this immigration is predominantly feminine. So, most of these women come alone, leaving spouses and family in the country of origin, or are single at the time of the migration, and need some time to initiate new relationships. A characteristic fact is that their fertility progressively seems to increase with years of residence but at levels close to those of autochthonous women. On the other hand, Europeans women are the only group with lower fertility levels than natives one. Their anticipation effect is the weaker and the recuperation effect is intense only after 2 to 7 years of residence. In this case we should remember that most of European population has in common with the Spanish one the fact of having low or very low fertility levels in comparison with others regions in the world.

The women born in African countries have a much higher fertility levels than the other two groups before and after migration. Their higher overall fertility explains why the anticipation effect seems to the 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 at duration -3 and the highest value at duration 3 are well above the corresponding values for the other two groups. We observe also the presence of a strong convergence (or adaptive) effect, as there is a downward trend in the curve beginning at duration 3. The African migration to Spain is usually made of men who arrive alone and later reunify with their spouses. So the arrival of African women is mostly explained by family reunification rather than for labor reasons. This may explain why the relative level of fertility just after arriving in Spain is so high. And even if the economic and personal costs implied by the migration process are high, the fact that having a child in Spain has added legal, social and economic benefits for these women also explain why their fertility is so relatively high in the first 5 years after their arrival.
Figure 6. Immigrants’ fertility by duration since migration and by origin, relative to natives’ 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 look at the same data by origin and taking into account the union status at time of migration (Figure 7), we observe that the biggest differences between women who have migrated while being in union or not is for African women, while the pattern of the three effects is much more similar for women born in a European or a Latin American country. Generally speaking, there is almost no anticipatory effect, and the recuperation effect takes place much later, at duration 5 years or more for women not in union. As we observed in Figure 6, the recuperation effect is the fastest (and even anticipates the migration movement) and the adaptive process is much clearer for women in union at time of migration than if we look at the curves for all women. That would suggest that migration of African women is strongly related with their union status since most of them are in union at time of migration. Finally, for Latin-Americans women, we observe that the fertility level of women in union or not at time of migration is closer among them before and after the movement, and closer to native’s level as well, which make of this group the one with less impact of migration discontinuity. For women in union, the recuperation effect takes place later than for European or African women, probably because the
American women tend to arrive alone, leaving their partner or husband in their country of origin. This may explain why the recuperation effect is so weak in this group, so in this case the disruption effect of migration may lead to an overall lower fertility level compared with women who didn't migrate.

Figure 7. Immigrants’ fertility by duration since migration, by union status at moment of migration and by origin, relative to natives’ 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. Discussion

In this paper we explored the effects of the migration process and the length of stay in Spain on fertility behavior of migrant women, analyzing the shape of their fertility curves by duration. We were able to found several instances of interaction between migration and fertility. Firstly, we identified an intermediate stage of immersion in the cultural and economic context of the host society for the women who arrived before 13 years of age and grew up in Spain. Their fertility patterns do not differ in their timing from the natives, but their slightly higher intensity may be the consequence of a socialization process still taking place in between the two contexts. Since migration in itself did not disrupt their fertility, we consider that her immigrant origin may have a role in their behavior. A second group of women, those who arrived as teenagers, differs from the previous group in the earliest timing of their fertility. This fact may illustrate both the importance of age at arrival -as they spent their child years in their country of origin- and the duration of stay -because they had births after fewer years of residence than the previous group- in shaping the fertility and other associated behaviors.

Thirdly, we saw how women who arrived in their twenties have divided their fertility between the place of origin and of destination. They have had children at early ages as expected from the general pattern of timing for immigrant women, and once installed in Spain they have in some cases spread and in others increased their fertility afterwards. In any case, the intensity of the post-migration fertility of these women is closer to the natives one. Also, the closer to thirty is their age at migration, the higher is the disruption in their reproductive life.

The fourth pattern observed is that of women who arrived in Spain after 30 years of age. These women had spent most of their fertile years in their country of origin, but as a result of migration they experienced a recovery of their fertility at a late stage of their reproductive life, either through family reunification or new unions. We observe also that the greater the age at migration is, the lower the time they wait to have a baby in Spain, as if the end of the 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 have migrated as children or as teenagers do not experience this effect for obvious reasons. Teenagers’ curves show what could be called a causal effect, which link migration to fertility. Women who delay their maternity in the years before the migration experience, experiment
afterwards an arrival effect which is characterized by a high level of fertility in the early years of residence, probably closely linked to family reunification. However, among those who migrated in their twenties and thirties, the arrival effect expands in time and after a period of more than 8 years of residence is intensified in which one might call an installation effect which includes time for social inclusion and even new conjugal relationships. Finally we conclude that after a high fertility post-migration period, there is a convergence or adaptation effect for young immigrant women, since the convergence among those who migrated in the older age group is caused by the end of childbearing age span. It is also important to keep in mind that what may appear as an adaption process may be only the consequence of an interruption effect, that is, 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 to the native and the rest of origins. 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 just after the arrival. Their labor insertion is lower than other non-native groups. If we add that their fertility is also high in their country of origin and that having children in Spain has the added value of a series of social guarantees, it is not surprising that these women contribute significantly to Spanish fertility.

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

By using longitudinal data we have been able to achieve a more accurate view of migrant’s fertility than previous research on the Spanish case. The duration model developed in this work constitutes an exploratory approach to study fertility patterns in a life cycle perspective. However it could be interesting to deepen on this research topic into two directions. Firstly, it would be nice to have larger samples of immigrant population as an essential requirement in order to analyze migrants’ behavior of people of separate or smaller groups of countries rather than continental aggregations. Secondly, it could be
important as well, to look at what factors or specific determinants (demographic, economic or cultural) are behind each of the observed effects. Future research may consider how elements as religion, educational skills, occupation or number of live children the women already have are related with migrant’s 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, something that regretfully we have not been able to do with the survey we use, as it does not include full paternal history.

On this paper we have presented a preliminary analysis and we would like to go further on this research. The main problem we want to solve is the issue of testing the significance of the coefficients that measure the effect of duration (until or since migration) on fertility. The issue is to determine whether the duration coefficients are significantly different from 1 (whether the fertility level is different from autochthonous women). The models we use are non parametric in the sense that we include a coefficient for each single age and for each single duration. So 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: fit the duration curves by mathematical function with 3 or more parameters and test the significance of each one of these parameters. One promising methodology we want to explore is the use of fractional polynomials (Royston and Sauerbrei, 2009).
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