Increasing childlessness in Europe: the contribution of changes in structure and propensity

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Introduction

Substantial changes in female access to education and family formation patterns in most European countries have been accompanied by a gradual increase in permanent childlessness.
The trends in the prevalence of childlessness at the end of individuals' reproductive age are remarkably similar across European countries: a peak in childlessness rates for the 1880-1910 birth cohorts, a more or less continuous drop across the 1910-1945 birth cohorts, and a steady rise across the cohorts born after the Second World War (Rowland 2007). The lowest proportion of childless women indeed are observed among the cohorts of women born after the war (1945-49) in most Countries, while higher levels are usually registered both among the older and the younger cohort.
However, regional differences exist in the proportion of childless individuals. Eastern European countries show the lowest levels of childlessness and the slowest temporary (30-39 years old individual) and permanent (40-49 years old individuals) childlessness growth rates. Probably those countries are still not experiencing to a significant extent the phenomenon of parenthood postponement. In Western countries, instead, strong and sometimes very rapid increases are registered.
Even if to variable extents, childlessness has always existed; what seems to have changed, together with the proportion of childless people, is the composition of the childless groups, in terms of both motivations and social characteristics.
Childlessness is a cohort phenomenon. Having no children is the result of decisions and behaviors that cumulate over the reproductive life course. Members of a birth cohort make decisions about childbearing and family formation in response to shared social and economic conditions. Changes in the social environment faced by cohorts over the twentieth century, as well as changes in the composition of cohorts, have the potential to explain long-term trends in childlessness.
The goal of this study is not to understand the individual-level determinants of childlessness, but to identify which of the large-scale demographic changes in the second half of the twentieth century in Europe are most closely associated with changing levels of childlessness.
By specifically focusing on education and marital status, we want answer the following questions: which of the demographic changes occurred in Europe in the last decades are most closely associated with changing levels of childlessness, and which is the role propensity toward childlessness plays in this mechanism? Does it fuels or counterbalances compositional changes, and how does it change over birth cohorts?
We try to disentangle between increases of childlessness caused by the structural changes in population (specifically the growth of permanent celibacy or the increase of women education) and by variations in the propensity towards childbearing by using Fairlie's decomposition technique, in a logistic regression framework.

Data and methods

Survey samples are usually too small to conduct robust analysis on childlessness and they rarely give the possibility to compare cohorts born in time span of 30 years. This is the reason why we use standardized census data from IPUMS (Integrated Public Use Microdata Series)-International database that allow comparative research across countries and over time without further adjustments.
Among the 11 European countries included in the database, only four countries have been selected: Austria, Spain, Romania and Hungary on the basis of the availability of the variables needed for the analyses and of the peculiarity of the fertility and childlessness trends they show over birth cohorts. We also include Italy in the analysis, as the southern European country with the highest childlessness levels. As far as Italy is concerned, data from the Multipurpose Italian survey, Family and Social Actors (2009) are used.
Even if belonging to the same geographic area, and even if being quite close countries, the selected countries display different childlessness histories and trends. We want to analyze if and to what extent changes in the population composition determine childlessness changes, both among different birth cohorts in each selected country, and across countries. The focus is on 46-50 years old women born in 1930s, 1940s and in 1950s.
A Fairlie's decomposition technique is used to disentangle between propensity and structural effects. Fairlie's decomposition is an efficient method, the only statistics it needs are coefficients' estimates of linear regressions for the groups of interest and the sample means of independent variables used in the regressions. It can be used also with dependent variable of binary nature, and thus it overcomes the main limitations of other decomposition techniques.

The decomposition (Fairlie, 2005) can be written as:

$$\bar{Y}^B - \bar{Y}^A = \left[\sum_{i=1}^{N^B} \frac{F(X_i^B * \beta^A)}{N^B} - \sum_{i=1}^{N^A} \frac{F(X_i^A * \beta^A)}{N^A}\right] + \left[\sum_{i=1}^{N^B} \frac{F(X_i^B * \beta^B)}{N^B} - \sum_{i=1}^{N^B} \frac{F(X_i^B * \beta^A)}{N^B}\right]$$

where N^j is the sampling size for j-th group, A and B the two groups compared, $\bar{Y}$ the mean probability to become childlessness.

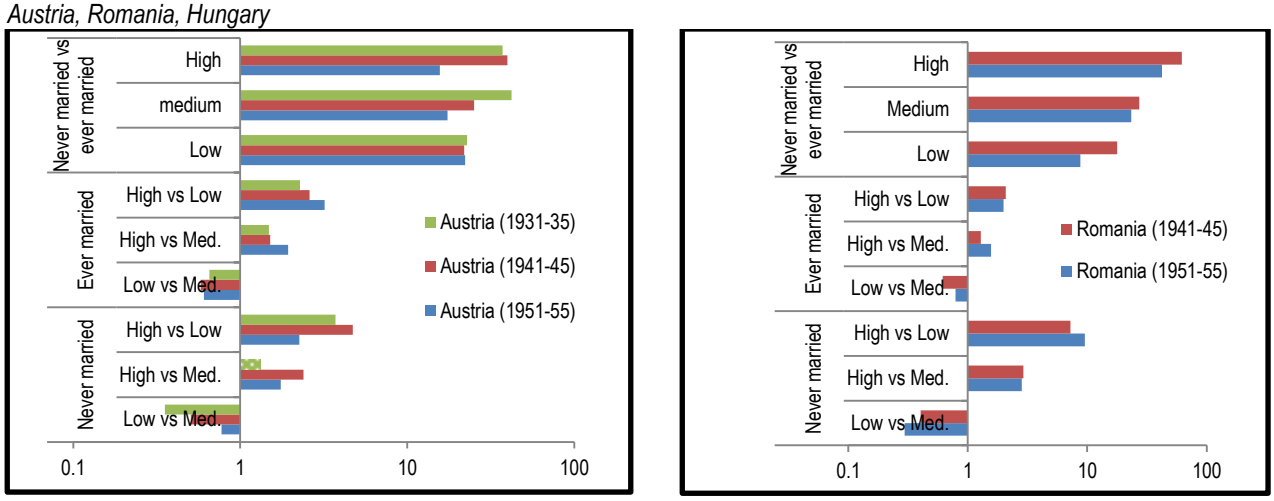
The estimation of total contribution is relatively easy because the only necessary data are the predicted probabilities and the difference between mean values of the groups. It is however helpful using another formula, to identify the different contributions of the single variables in structural changes.

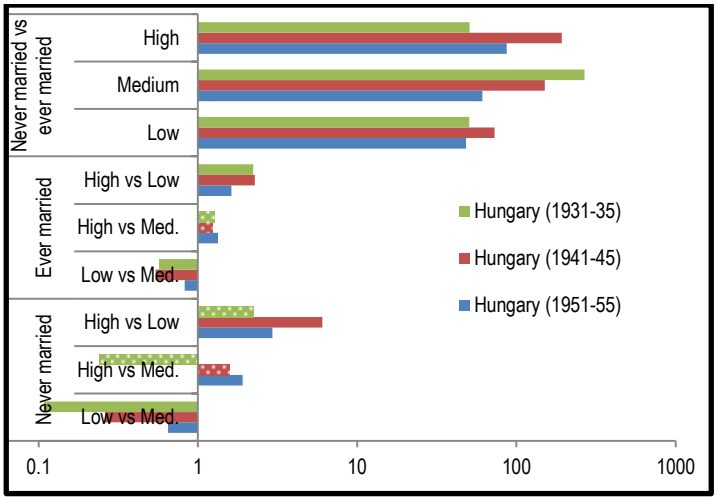
The contribution of each variable to the difference within the groups is equal to the variation of mean predicted probabilities, and is obtained switching the distribution of childlessness women in the two groups, by fixing one standard distribution. Probably, the two groups have not the same sampling size, so it is necessary to put together the observations from the two samples to be compared. To solve this problem, predicted probabilities for the entire sample are calculated. Successively, a random subsample from the most numerous population, of the same size of the smallest one is chosen. To each observation in the two samples, a rank depending on the predicted probability value is assigned and, sequentially, the groups are put together. Obviously, the estimations depends on the subsamples, excluding the other records. A simple method to solve this problem is to sample a big number of subsamples with replacement. After the calculation of each contribute, we find the mean of 1000 values obtained from a simulation approach. This mean value should be the one which approximates the contribution of that specific variable in the best way. Computations have been made using SAS 9.3.

Testing the influence of education and marital status on childlessness: logistic regression results

As said before, the decomposition approach used in this study is implemented in a logistic regression framework. Before analysing how changes in the population structure (specifically change in education and family formation patterns) have influenced, at a macro-level, changes in childlessness, we run a micro-level analysis for understanding if and to what extent the variables of interest influence childlessness, and how this influence have changed over birth cohorts. Results on the interaction terms between education and marital status are displayed. Estimates obtained from the Italian sample resulted to be scarcely robust, due to nature of available data (survey data, with a limited sample size), and therefore they will be not presented.

Figure 1: Results of logistic model (marital status, education level and interactions term as independent variables) – Odds ratio. Austria, Romania, Hungary





Dotted bars represent not significant odds ratio (95% significance level)

Results show that the influence of marital status on childlessness is stronger than the influence of the education level: never married women show very high risk to be childless. The magnitude of the effect varies across countries.
The impact of marital status on childlessness decreases over birth cohort, thus confirming that declines in marriage that would be expected to lead to lower birth rates and more childlessness, are counteracted by a growth in non-marital birth rates: the weakening of social norms makes more acceptable and more common to have out-of-wedlock births (in most cases in a stable cohabitation).
Never married women with high and medium education show the greatest risk to be childless at the end of their reproductive life.
Education has a less relevant influence on the likelihood to be childless, in spite of the spread of higher education (secondary and also tertiary) across cohorts.
An educational gradient emerge, and is confirmed to be significant, above all among the most recent birth cohort. Among ever married women, the educational gradient in childlessness of high versus low educated women, and of low versus medium educated women diminishes consistently in all countries except in Romania. Anyway, highest educated women show the highest risk to be childless.

Changes in the population structure

Before assessing the contribution of compositional changes to trends in childlessness we describe how educational attainment and marriage behaviour have changed over the considered birth cohort.

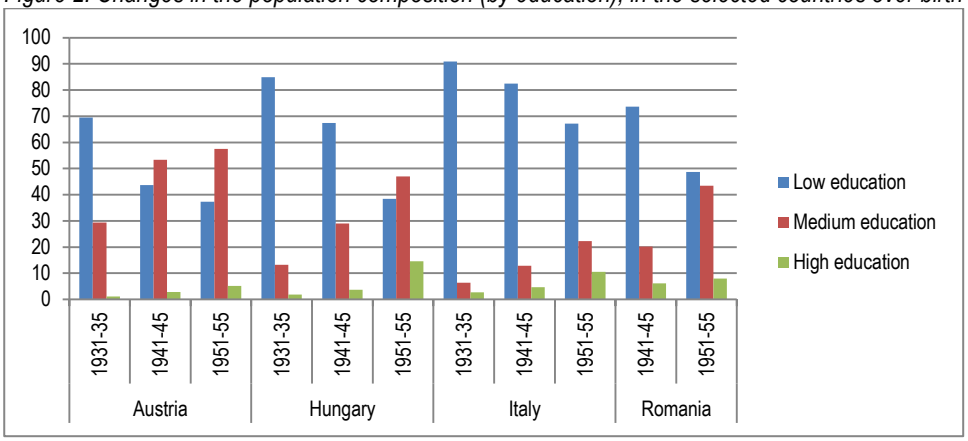
Table 1: Changes in the population composition (by marital status) in the selected countries, over birth cohort

	Birth cohort	Never married	Ever married
Austria	1931-35	8.39	91.61
	1941-45	7.46	92.54
	1951-55	9.49	90.51
Hungary	1931-35	3.98	96.02
	1941-45	3.88	96.12
	1951-55	4.59	95.41
Italy	1931-35	8.13	91.87
	1941-45	5.9	94.1
	1951-55	8.27	91.73
Romania	1941-45	3.06	96.94
	1951-55	5.54	94.46

Austria and Italy (southern-central Europe countries) show the same trend in the composition of population by marital status: the percentages of married women decrease for the 1941-45 birth cohort, and increase for those born in 1951-55, without overcoming the levels registered among women belonging to the oldest birth cohort. In Italy the phenomenon is more pronounced.
As far as Eastern Europe countries are concerned, they show the highest levels of ever married women and, consequently, the lowest levels of never married women. While the Western democracies experienced the beginning of

great social changes since the late 1960s, post-materialistic values could not spread in those countries where regimes actively promoted sexual puritanism, conservative gender roles, and social policies that supported the traditional family consisting of married couple with children.

Figure 2: Changes in the population composition (by education), in the selected countries over birth cohort



Data in figure 2 show that the main changes in the educational structure of the populations under analysis concerned the women with low and medium education, whose percentages show opposite trends. Percentages of medium and low educated women inverted among the most recent analyzed birth cohort, both in Hungary and in Austria. Moreover, Hungary shows the fastest increase in the proportion of highly educated women. Italy shows the highest percentages of low-educated women, in all the birth cohorts. It also displays constant increases in the percentages of women with high level education. Romanian birth cohorts taken into account seems to be strongly involved in the process of education transition.

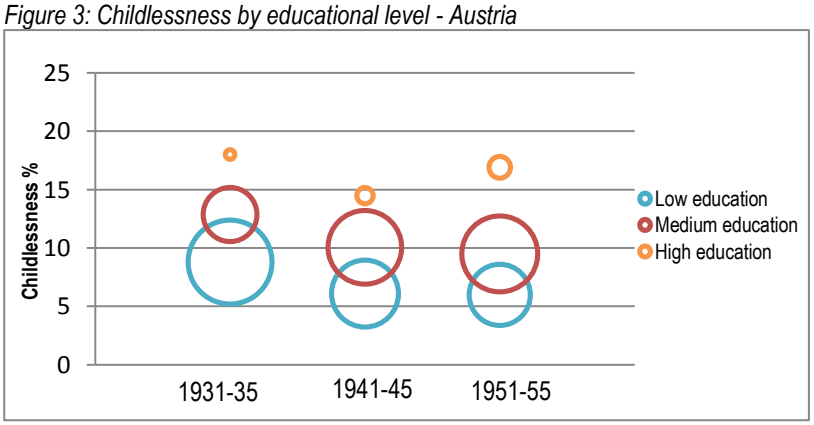
The share of women with high education, is below 5% almost everywhere, with the exception of Italy and Hungary. It increases almost linearly but usually at a slower rate with respect to medium-educated women.

Unfortunately, in the cohorts presented here is not yet visible the change occurred in the last decades, when high education spread very quickly.

From micro to macro

In figure 3 childlessness in Austria by educational level is displayed, for three birth cohorts. Beyond the childlessness level by education the figure gives an additional information: changes in the educational composition of female population, represented by the size of each circle. The following figure may help understanding where the objective of this work originate from.

Figure 3: Childlessness by educational level - Austria



The size of each circle represents the proportion of low, medium and educated women in each birth cohort.

By looking at changes in the female population composition by education, an increase in childlessness should be expected, given the increase in the proportion of both middle and high educated women, that should imply increases in overall childlessness levels, and also given the decrease in the level of low educated women, that are expected to be the less childless groups. However childlessness among married women belonging to the oldest birth cohorts in Austria

decreases. This is probably due do to the effect of propensity and attitudes toward childlessness that may counterbalance compositional changes in education.

Childlessness decomposition results

The decomposition analysis is articulated in two steps: in the first part a study among cohorts born in different years in the same country (longitudinal analysis) has been carried out, while in the second part the focus is on the same cohort resident in different countries (cross-section cross-country analysis).

Table : Results of Fairlie's decomposition for Austria. Longitudinal analysis (reference: eldest cohort)

AUSTRIA	1931-35	1941-45	1941-45	1951-55
Childless women (%)	15.53%	12.92%	12.92%	13.76%
Difference	-2.61		0.84	
Marital status contribution	-0.6		1.03	
Education contribution	1.46		0.63	
Predicted childless women (%)	15.53	16.36	12.92	14.57
Change in propensity	-3.47		-0.82	

The results of the longitudinal analysis show that childlessness levels diminished among women born 1940s in Austria because the structural changes, a slight decrease of never married women, and a more consistent increase of more educated women, that would have favored an increase in childlessness levels, have been more than compensated by an higher propensity to childbearing. As far as the 1951-55 birth cohort is concerned, the effect of population increases in the proportion of both never married women and more educated women, makes childlessness level growth. The increased permanent celibacy and education levels among women are no more compensated by propensity in favor of childbearing. The propensity toward childbearing counterbalances, but to a certainly lower extent with respect to the effect it had on the previous birth cohort childlessness, changes in the population structure, that are the responsible of childlessness increases.

Table : Results of Fairlie's decomposition for Hungary. Longitudinal analysis (reference: eldest cohort)

HUNGARY	1931-35	1941-45	1941-45	1951-55
Childless women (%)	11.61	9.21	9.21	8.00
Difference	-2.40		-1.21	
Marital status contribution	-0.21		0.55	
Education contribution	1.19		1.43	
Predicted childless women (%)	11.61	12.59	9.21	11.19
Change in propensity	-3.38		-3.19	

In the considered Hungarian birth cohorts changes in the population structure by education level contribute in a stronger way in determining childlessness levels, with respect to changes in the marital status. Higher levels of childlessness should be registered with respect to the reference birth cohort. However, the strong effect of education changes is counterbalanced by high propensity toward childbearing, thus making - unexpectedly - childlessness decrease.

Table : Results of Fairlie's decomposition for Italy. Longitudinal analysis (reference: eldest cohort)

ITALY	1931-35	1941-45	1941-45	1951-55
Childless women (%)	14.01	11.36	11.36	12.32
Difference	-2.65		0.96	
Marital status contribution	-1.81		1.85	
Education contribution	0.14		0.29	
Predicted childless women (%)	14.01	12.34	11.36	13.5
Change in propensity	-0.98		-1.18	

In Italy, changes in childlessness are mainly influenced by the compositional changes in marital behaviors. The propensity toward childbearing increases over birth cohort, without compensating the effects of changes in the population structure.

Table : Results of Fairlie's decomposition for 1950s cohorts. Cross-country analysis (reference: Italy)

	Italy	Austria	Romania	Hungary
Childless women (%)	12.32	13.76	9.83	8
Difference		1.44	-2.49	-4.32
Marital status contribution		0.99	-2.24	-3.02
Education contribution		0.96	0.61	0.98
Predicted childless women (%)	12.32	14.27	10.68	10.27
Change in propensity		-0.51	-0.86	-2.28

When running the cross-countries comparison (using Italy as the reference country) it clearly emerges that changes in the proportion of women marrying explain substantial differences in childlessness among the considered countries, net of other factors.
Changes in marriage rates explain the largest proportion of the cross-country differences in childlessness. Changes in the proportion of high educated women is confirmed to have the lowest impact on childlessness differences.
Compositional changes effects, even if softened by a general higher propensity toward childbearing with respect to Italy, are responsible of cross-countries childlessness differences.

Conclusion

Both in Austria and Italy - the countries with the highest childlessness level in the selected group countries - the propensity registered for the oldest birth cohort is not able to compensate the positive contribution of education and marital status changes on childlessness. In the other countries, the evolution of population structure seems not to have influenced childlessness levels that much, but it seems plausible to hypothesize that the process that involved Austria and Italy since 1950s cohorts will spread also in the remaining countries for women born after 1960.
By looking at the results obtained through the decomposition approach, it is possible to hypothesize that the improvements in women's education has not been accompanied by a lower propensity to childbearing, as the pro-natalist attitudes and the family values seems to be still solid in most of the analyzed countries.
The process of change of attitudes and values among women seems to have a slow rhythm. Values take more time to spread and become rooted in each birth cohort, and act on childlessness with a certain delay with respect to compositional changes.
Analyzing the most recent birth cohort would help understanding if changes in the structure of the female population by education occurred in the last decades are accompanied by a lower propensity toward maternity, due to a transition to post-materialistic values which can be characterized by substantial changes in attitudes to marriage, family and sexuality.
Changes in the couple formation choices have a higher influence on childlessness than education (with the exception of Hungary). However, it is important to notice that those attitudes tend to decreases over the considered cohorts.
The analyzed birth cohorts do not allow to capture the decreases of the importance of marital and partnership status in determining childlessness levels. It would be interesting to understand if, among cohort in which marriage in no more the most widely accepted arrangement for childbearing, the contribution of education overcome, in terms of strength, those of marital status.