Climate Change and Reproductive Intentions in Europe

Alessandra De Rose* & Maria Rita Testa**

* Sapienza University of Rome

* Vienna Institute of Demography

Abstract

It is widely recognized that climate change is anthropogenic and that a continuous worsening of environmental conditions has strong impacts on populations' and individuals' well-being. Besides the direct negative effect on mortality and morbidity climate change threats traditional livelihoods. Loss of livelihood may encourage out-migration and may constitute an obstacle for having children.

In response to climate change people may change their attitudes and choose to adopt more responsible behaviors. Aim of this paper is to investigate the effects of environmental conditions on human reproductive behavior in the highest industrialized countries. We discuss the hypothesis that individuals fearing for a foreseen unhealthy environment tend to delay childbearing or give up having children, thus contributing to a reduced ecological footprint. These effects could result in further fertility reduction or limited recovery in the years to come.

Keywords: climate change, fertility intentions, environmental condition, fertility, multi-level analysis, Europe

1. Introduction

The harsh impacts of climate change and related hazards are increasingly being felt across the world. A large consensus has emerged among natural scientists about the nature and the impact of climate change. It is widely recognized that climate change is largely anthropogenic and that, in turn, a continuous worsening of environmental conditions has a strong impacts on populations' and individuals' well-being (Lutz 2009).

Besides the direct negative effect on mortality and morbidity caused by extreme events such as severe storms, hurricanes, inundations, etc., climate change threats traditional livelihoods and people will likely be exposed to increasing health hazards resulting from changing regional and temporal pattern of temperature and humidity, which may impact agricultural production and the spread of certain diseases.

Loss of livelihood may force or simply encourage out-migration (McBean&Ajibade 2009) but also social disruption and economic hardship. It has been demonstrated (Rendall 2011) that Hurricane Katrina occurred in the city of New Orleans in 2005 caused an excess breakup of unions besides and after the direct impact on family disruption. Similar effect could be expected on human reproduction, though the studies on that are still lacking (Rendall cit.).

Whether and to what extent these hazards will result in human fatalities depends on the vulnerability of the people affected or positively put, on their robustness and resiliency, which are in turn affected by economic and cultural development level of the

population involved. This result in different strategies adopted for strengthening adaptive capacities for coping with unavoidable climate change (Lutz cit.).

In countries where the environmental sensitivity is the more and more spread, people response to climate change also adopting more responsible behaviors and changing their attitudes.

Aim of this paper is to investigate the effects of the worsening environmental conditions on human reproduction in the highest industrialized countries. On the one hand, we will document the biological effect of pollution on fecundity and reproductive health of women and men; on the other hand, we will discuss the hypothesis that individuals fearing for a foreseen unhealthy environment may adopt attitudes and behaviors leading to delay childbearing or give up having children, thus contributing to a reduced ecological footprint. Both these effects could result in further fertility reduction or limited recovery in the years to come.

2. Background

2.1 Climate change and health

The Fourth Assessment Report of the IPCC (International Panel on Climate Change) highlighted that climate change and its variability are and will be a threat to human health (Christensen JH et al. 2007).

Climate change contributes to the global burden of disease and premature death. Growing evidence of the effects of changes climate on human health indicates that climate change not only alters the distribution of some infectious disease vectors and the distribution of some allergenic pollen species but has also increased the risk of death linked to heat waves. In the future, the expected trend of exposures significant for human health related to climate change indicates an increase in malnutrition and in the amount of people subject to disease and injury due to heat waves, floods, storms, fires

and drought. In addition, the weight will rise in the rate of diarrheal diseases and the frequency of cardio-respiratory diseases due to higher concentrations of ozone. We can also expect that climate change will have some beneficial effects on health, such as, for example, less deaths from cold. It is expected, however, that this benefit is unbalanced by negative effects of rising temperatures worldwide, especially in developing countries (Confalonieri et al. 2007).

However, research on specific aspects of climate-health relationship is still at an early stage because there is uncertainty about the chemical and biological processes by which climate affect the diseases structure, because there are no epidemiological studies on a large scale, and because it is difficult to model the many aspects of human health.

Namely the research over the toxic effects that many substances have on reproductive apparatus, both male and female is relatively recent. The experimental, clinical and epidemiological studies indicate that reproductive health, from production of sperm and oocytes, to fertilization and intrauterine and postnatal development of the offspring, may be a particularly vulnerable target (Stazi&Mantovani 2001).

Special attention is devoted to endocrine disruptor chemicals (EDC) that are a group of contaminants of environment and food interfering with endocrine homeostasis, especially of sexual steroids and hormones thyroid. The definition most commonly accepted reports: "an endocrine disrupter is an exogenous substance, or a mixture, which alters the functionality of the endocrine system, causing effects adverse health effects in an organism, or in its progeny, or in a sub-population".[1] It has been widely documented EDCs have serious potential impact on reproductive health, such as infertility, uterine pathologies (for example, endometriosis), malformations of the reproductive system (i.e., hypospadias), increased susceptibility to tumors of target

[1] European Workshop on the Impact of Endocrine Disrupters on Human Health and Wildlife. Weybridge December 2-4, 1996.

tissues (for example, testis). Studies conducted so far demonstrate the role of specific chemicals substances which selected professional categories are exposed to, but also show an increase of the effect of more common homogeneous groups of toxic substances (pesticides, metals, dioxins, etc.) which a large part of population is exposed to in common livelihood (Maranghi & Mantovani 2003).

Although a significant impact on population level fecundity is still to be proved (Bonarini, forthcoming) the worrying about a possible diffusion of these health alerts due to a worsening of environmental conditions and related climate change is hard to ignore.

Finally, climate change could have an effect on psychosocial health. The increasing perception of risk of fatal event, or environmental disasters, deeply affects physical, mental and emotional health of people (Costello et al. 2009). Even those who escape death or injury can be left traumatized by the loss of relatives, friends and belongings. At societal level, the uncertainty might cause increased levels of psychological stress because of instabilities, both a perceived and a real one (Fritze et al. 2008).

2.2 Climate change and human choices

An important question to be answered is whether and how people contribute to moderate the environmental risks or react to them by making informed or wise choices. Humans can choose to respond to the prospect of climate change and can decide, with certain degrees of freedom, what steps to take. At community level, they can develop new technologies that will allow economic development while reducing the anthropogenic contributions to climate change. Since it is a global issue, the obvious decision makers are the governments of nation states who have enjoyed legitimacy as the arbiters of high policy throughout the modern era. People usually expect their

governments to choose goals (such as emissions reductions) and policy instruments (e.g., a carbon tax). This is the reason why most of the social sciences research on the topic of climate change focuses on the macro level of national and international political choices. However, research at the macro level may reduce important dimensions of actions and decisions taken at different levels, closer to the individuals. The slogan, "Think globally—act locally" expresses the widespread recognition that choices are made at the micro level, by individuals and groups in particular places. Even in the context of national or international regulations, firms, families, communities, and citizens choose how to respond to incentives and sanctions, or to try independent and voluntary strategies to moderate or adapt to environmental issues, by means of responsible behaviors (Rayner & Malone 1998).

The voluntary childbearing limitation - strongly advocated by international institutions - can be considered as a responsible behavior that individuals adopt both to reduce the ecological footprint and to avoid exposing a new pregnancy and the unborn child to environmental risks.

Here we explore the hypothesis that in Western countries, particularly in Europe, the spread of environmental awareness and the fear of the effects of climate change are the more and more popular as reasons not to have children or to delay its calendar.

2.3 Climate change and fertility intentions

The relationship between environmental concerns and fertility is an issue that has not received a great deal of attention in the literature (Swim et al.2009). Recent studies have demonstrated a link between local environmental concerns and reduced fertility (Ghimire and Mohai 2006). The authors of this study examined the relationship between three specific environmental concerns (agricultural productivity, water quality, and status of groundwater table) and contraceptive use in Chitwan Valley, Nepal, and

they found that concern over crop production was positively associated with contraceptive use, after controlling for a set of relevant demographic variables. They argued that the impact of increasing environmental concerns on fertility behavior may be more prevalent in societies where locally used resources are scarce.

There has been only little empirical investigation in the relationship between environmental concerns and fertility intentions. An important exception is the study carried out in the Thunder Bay (Canada) by Arnocky et al. (2012). This research has shown that couples who believe that pollution has affected their physical and mental health tend to have a less positive attitude toward having children and desire to have fewer children in their lifetime than people not concerned about the negative impact of pollution on their health status (Arnocky et al. 2012).

One complicating thing is the complexity of the causal mechanism behind this relationship: it can be that when ecological conditions are perceived as being unfavourable to childbearing, individuals see raising a large number of children as too difficult; but, on the other side, having more children will be unfavourable because of the negative effects of population growth on the local environment. Thus, having fewer children may be considered an effective means of reducing one's carbon footprint.

3. Research hypotheses

There are two main types of environmental concerns that can be considered in a study of fertility intentions: the first one involves concerns about humanity's role in affecting natural environment; the second one considers concerns with human beings' health risks due to pollution. In relation with fertility intentions these concerns can be translated as follows: individuals who believe they can make a positive contribution to the environment may tend to remain childless; alternatively, they may believe that poor environmental quality may threaten the well-being of potential offspring. Of course,

fertility intentions are determined by a set of different individual- and contextual-level factors and it is difficult to disentangle the impact of subjective environmental concerns from the influence of all these other factors at both individual and contextual level.

In this study, we suppose that individuals' fertility intentions are negatively influenced by their environmental concerns (**research hypothesis 1**) and that this relationships holds not only at individual but also at country level across the EU countries (**research hypothesis 2**); moreover, the negative climate change – intention relation is significantly mediated by educational level: people who are better educated and do have concerns on climate change tend to indicate a preference for larger family sizes than their less educated and worried counterpart (**research hypothesis 3**). The more educated people may think that the environmental challenge can be faced successfully with some progress and responsible behaviors.

4. Data

The empirical analysis is based on the Eurobarometer surveys carried out in 2011 in the 27 EU countries. In this survey the stratified sampling procedure assures nearly equal probability samples of about 1,000 respondents in each of the countries. The sample size allows equally precise estimates for small and large countries, as well as to make comparisons between sub-groups broken down by sex, age, education, marital status, and so on. The surveys used a single uniform questionnaire design, with particular attention being paid to equivalent question wording across languages.

The analytical sample consists of 8278 people aged 20 to 45 who answered the question on fertility intentions: 3556 childless, 2096 with one child, and 2626 with two children. The non-response rate was slightly less than 15%. A missing answer may be symptomatic of certain fertility plans (Morgan 1981 and 1982). However, we simply excluded from the analysis all individuals who did not report any intended family size

in order to avoid potential complications given the absence of auxiliary information on this item. The results obtained from the analysis run on the sub-set of valid responses are reliable under the standard "missing at random assumption" (Little and Rubin 2002).

The models are formally based on two levels: individuals and countries (referred to as "clusters") as described in **Table I**. As is shown in this table, the hierarchical structure is quite unbalanced. This lack of balance is not a problem, as it is efficiently handled by maximum-likelihood methods. The number of clusters and their sizes are sufficient to achieve high levels of power and accuracy of the asymptotic distributions of the estimators (Stegmueller 2013; Snijders and Bosker 1999), and thus allow for reliable inferences. Multilevel models assume random sampling at all levels, while our survey design in fact does not use sampling at the country level. Even in this latter case the use of multilevel models is justified on the basis of the advantages offered by this approach, i.e., explicit inclusion of country-level explanatory variables and country-level residual variation in the models (Hox et al.2012).

For the estimates computation we used the program gllamm which runs in the statistical package Stata and estimates GLAMMs (Generalized Linear Latent and Mixed Models) by maximum likelihood, i.e., via a maximization algorithm with adaptive quadrature, assuming Gaussian random effects (Skrondal and Rabe-Hesketh, 2004).

5. The model

Multilevel models were run in order to represent the complex causal process underlying the behaviour of individuals living in a social context, and to draw valid inferences regarding the relationships at the relevant hierarchical levels. As is usual in a

multilevel setting, the clustering of individuals in countries is a phenomenon of interest, rather than a mere disturbance (Snijders and Bosker 1999).

In **Figure I**, freely inspired by Coleman (1990), the multilevel framework is adapted to the study of individual's lifetime reproductive intentions. The box visible at the top right of the scheme is related to fertility rates, which are not investigated in the current analysis, but depend on the relationship explicitly considered in the current study. A crucial characteristic of the multilevel setting is that the effect of the context on the individual outcome can be estimated after a control for the individual-level characteristics is included in the model (the diagonal line in the scheme).

The multilevel analysis relies on the random intercept version of the proportional odds model for ordinal responses (e.g., Agresti, 2002). All of the models were run separately by parity: zero, one, and two children. As was stated in the rational choice theories approach (Yamaguchi and Ferguson 1995), fertility intentions may change after each new birth, in line with the concept of a conditional-sequential fertility decision-making process (Namboodiri 1972). The preference for models stratified by parity over pooled models with parity interactions is reinforced by reasons of parsimony. A problem arises when there is selection in a parity-specific analysis; i.e., there are unobservable variables that could be correlated with the probability of having a child in parity n, as well as with the probability of intending to have a child of the next order, n+1. The consequence is a biased and inconsistent estimator. This problem is not tackled here because of a lack of adequate longitudinal retrospective information, but the related issue is discussed in the concluding section.

The proportional odds model could be extended to handle partial proportional odds (Williams 2006), but then the interpretation becomes somewhat tortuous. Since only a few covariates in each model violated such an assumption, and since they did so only slightly, the proportional odds multilevel models were preferred.

5.1 Response variable: lifetime fertility intentions

The response variable, i.e., the intended number of children, was measured through the following item: "*How many more children do you intend to have?*" A range from zero to up to six children was given in the questionnaire as a response option. The prospective item was asked immediately after the question about the number of children already had ("*How many children, if any, have you had?*") and was clearly intended to provide information about the number of births respondents plan to have over (the rest of) their reproductive careers. Neither of the above-mentioned questions made a distinction between biological and adopted children. Moreover, since pregnancies are not measured in the survey, it cannot be excluded that pregnant women reported the children already conceived at the time of the survey as expected to be born, i.e., in the intended component of their ultimately intended family size.

The response variable was coded as a four-category variable: zero, one, two, and three or more children. Values greater than or equal to three were, in light of their low frequency, collapsed into a single category.

5.2 Explanatory variables

The explanatory variables of the models are as follows: age, sex, enrolment in education, level of education, marital status, employment status, and self-location on the social scale. All of the covariates refer to the time of the interview. Unfortunately, the data do not carry any retrospective information concerning the previous history of respondents, which would have allowed me to estimate the role of biographical trajectories on the process of forming family size intentions in a dynamic framework. The assumption of constancy over time is quite reasonable for some covariates, like, for instance, completed educational level; for the other covariates, we simply assume that

they exert an influence as they are measured at the time of the survey, independently on whether the different statuses (marital, employment, social) have been reached since long or short time.

The age of respondents is the only continuous covariate. It was centred on the rounded mean value of 33 years. As all of the other covariates are categorical, they were transformed into suitable dummy variables. Some collapsing of the categories was often needed: in such cases, several alternative collapsing schemes were tried in the model selection process.

The educational level was measured with the following survey question: "*How old were you when you stopped your full-time education?*" and considered as a three-category variable with low (up to 15 years) medium (between 16 and 19) and high (20 years or above) level of education. A dummy variable indicating whether respondents were still enrolled in education at the time of the survey was also added.

The marital status was coded using four categories: single, married, cohabiting, and separated. The 'separated' category included also divorced and widowed people not living with another partner at the time of the survey, while the married category included remarried people.

The employment status has three categories: employed, unemployed and not active in the labour market.

A description of all the variables used in the models is reported in **Table II**.

5. **Results**

5.1 Descriptive analysis

In the EU-27 as a whole, 20% of people of reproductive ages considered climate change the biggest problem of the future and 50% reported it as one of the biggest problem. There is a cross-country variation in the share of people who are concerned,

either weakly or strongly, that climate change will be a big problem in the future (**Figure II**). The percentage goes from around 30% in Luxembourg, Malta, Denmark, Germany east and Spain, to less than 10% in Portugal if we consider people who are strongly concerned. While it goes from more than 40% in Greece, Cyprus, Germany East, Slovenia and Sweden, to less than 30% in Malta, Lithuania, Latvia, Poland, Italy, Czech Republic and Portugal if we consider only those who are just weakly concerned about climate change (**Figure II**).

The mean ultimately intended family size, i.e., the sum of the mean actual and additionally intended number of children, is around two children in the EU-27 as a whole. There is a cross-country variation in both the mean actual and additionally intended family size: the mean actual family size goes from 0.8 in Italy to 1.6-1.7 in Latvia, France and Ireland. The mean additionally intended family size goes from 0.5-0.6 children in Portugal, Romania, Germany East and Luxembourg, to 1.1-1.2 children in Italy, Cyprus, and Ireland (**Figure III**).

5.2 Multilevel models

In Table VI we report the estimates from the ordinal regression models on additionally intended number of children. In Table 6, the estimates of the ordinal regression models with a random intercept for the additionally intended number of children are reported. The models were run separately by parity zero, one, and two. Only the additionally intended children was considered in the response variable, to avoid problems of reverse causality which we would have faced by explaining events occurred already in the past (i.e., children already born) with characteristics measured only at the time of the survey (all the explanatory variables are measured at the time of the survey). Explanatory variables have been included gradually in the analysis: model I is the empty one, model II includes only the individual-level variables, and model III

includes both the individual- and country-level variables. As the table shows (Models II), at individual-level the additionally intended family size is negatively associated with age (for all the three parities), with the status of being inactive (only at parity zero), or single or separated (at parity one); by contrast, it is positively associated with a high level of education, enrolment in education, and a high self-positioning on the social scale (for all the three parities). Moreover, there is a positive and statistical significant gender effect in all of the models run which suggests that men plan to have larger family sizes than women (**Table III**). Our key covariate, i.e., concern about climate change, has been included just as a dichotomous variable equal to one if people report to be strongly concerned about climate change, and zero otherwise. We did not keep in the models the additionally dummy indicating whether the people were just weakly concerned for reasons of models' parsimony, since the variable has never been statistically significant in the various specifications of the model.

As results of Table III show, people's concerns about climate change do not significantly influence individuals' additionally intended number of children. The relationship is, however, positive in models run on parity one and parity two and becomes slightly statistically significant in models for parity one. Unlike a negative relationship, as formulated in our initial hypotheses, the worries about the future because of climate change seem to be positively correlated with the intended family size, if any statistical significant correlation is detected at all. Moreover, this positive relationship does not change among the highly educated people, as suggested by the fact the interactions terms between climate change and high education have been never statistically significant, and hence, not retained in the final models reported in **Table III**.

Eventually, the variance at the country-level is highly statistically significant, which justifies the adoption of a multilevel approach, but the country-level variable

"concern about climate change" does not explain this variance in any of the models (Model I, II, and II) and the parities considered, as suggested by the fact that the country-level variance has not changed substantially after climate change variable has been included in the models at country-level.

6. Summary and concluding discussion

In this analysis we investigated the relationship between people's concerns about climate change and fertility intentions in Europe (EU-27) by using the EB 2011 survey data and an integrated micro-macro model in which individuals are nested in countries. According to our initial research hypothesis, the relationship between climate change and fertility intentions is supposed to be negative, at individual and country level. Moreover, a differential impact by level of education is envisaged in our initial research questions according to which such a relation should be negative for the low to the medium educated people and positive for the highly educated ones. We could not support any of these results on the basis of the empirical evidence coming from the EB data: first, the relation between concerns about climate change and fertility intentions was found to be positive; second, there was not any relevant difference in this relation between the more and less educated people; third, there was not any statistically significant association detected at country level. These findings may not come as a surprise: indeed the reproductive decision-making process is rather complex (Morgan et al. 2011) and involve many factors, such as norms, attitudes and behavioural control (Ajzen 1991; Ajzen 2010), which we could not include in this study.

The results are not in line with those coming from the research conducted by Arnocky et al. (2012) in which the pollution related health concern was related to lower fertility intentions. The discrepancy may lie in the different data, approach and

variables used. Arnocky and colleagues conducted their study in Canada and they used a variable measuring the impact of pollution on human beings' health conditions, while we just had a variable measuring the people's subjective perception of climate change as a major problem for the future.

Our data design has some limitations which may provide input for directions of future research on this topic. First, data are cross-sectional and thus they do not allow a dynamic study of the fertility decision-making process. Second, the limited national sample sizes prevent any detailed and reliable analysis at the national level, and moreover, the limited information available at individual level may cause the results to be biased due to omitted relevant variables. One relevant intervening variable in the relationship between climate change and fertility intentions could be the level of urbanization: sensitiveness to climate change problems may be expected to be higher in rural areas than in urbanized areas, since in the former ones there are more people who are employed in agricultural jobs, and hence, more directly exposed to some extreme weather conditions (flooding, droughts, etc). In a previous version of the analysis we have included a variable measuring the urbanization level of the area in which people live, as subjectively measured by the respondents. This variable, however, did not turn to be relevant in the reproductive decision-making (intended number of children) nor in the impact of climate change on the reproductive decision-making (interaction effect between climate change and urbanization degree of the area). Third, the EB data do not allow a modelling of the selection effects generated by the postponement of childbearing.

Moreover, the causal direction is assumed to run from people's sensitivity to climate change to people's fertility intentions, although in actually there will be some degree of reverse causation, which we are not able to disentangle with the data at hand. In an earlier work based on the EB 2011 data (Testa and De Rose 2013) and

in which the response variable in the models was the people's concerns about climate change, we found that ideal and the intended number of children were both positive and statistically significant correlated with the worries on climate change. This early finding coupled with those coming from the current analysis seem to suggest that people rather to see the choice of not having children (or having fewer children) as the most desirable one in an ecological perspective, start to think about the challenge related to the climate change when they have already planned or got children because they want to pass an healthy and enjoyable environment to their children's generation.

Eventually, 27 countries are not enough to produce very robust and reliable estimates at the country-level. Since the regional division of the EB data does not correspond to the NUTS 1 of the Eurostat, it was not possible to conduct the analysis at regional level while taking the regional-level variables from the statistics provided by Eurostat. It is hoped that it will be possible to address the issue in future studies on the basis of other data which do also measure the climate change threat more precisely.

Acknowledgements

An earlier version of this paper has been presented at the Italian Population Days, held in Bressanone, on February 7-9, 2013. We thank all the participants present at our session for their valuable comments. Any shortcomings are the responsibility of the authors.

References

Agresti, A. (2002). *Categorical Data Analysis.* Second Edition, New York, Wiley.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes, 50*: 179-211.

Ajzen, I. (2010). *Fertility intentions and the Theory of Planned Behaviour*. Paper presented at the International Conference on Reproductive Decision-making in a Macro-Micro Perspective, Vienna, December 2-3, 2010.

Arnocky, S., Dupuis D., and. Stroink M.L. (2012). Environmental concern and fertility intentions among Canadian university students.Population & Environment 34:279-292.

Christensen, J.H. *et al*. (2007). Regional Climate Projections. In: Solomon S, D. Qin, M. Manning, Z. Chen, M. Marquis,K.B. Averyt, M. Tignor and H.L. Miller, editor. Climate Change: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY, USA.: Cambridge University Press.

Coleman, J.S. (1990). Foundations of social theory. Cambridge: The Belknap Press of Harvard University Press.

Confalonieri, U. *et al*. (2007). Human Health. In: Impacts, Adaptation and Vulnerability. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

Costello, A. *et. al*. (2009). Managing the health effects of climate change. *Lancet* and University College London Institute for Global Health Commission. *Lancet*, 373. pp. 1693–1733

Fritze, J.G., Blashki G.A., Burke S., Wiseman J. Hope (2008). Despair and transformation: climate change and the promotion of mental health and wellbeing. *Int J Ment Health Syst,* pp. **2:** 13.

Ghimire, D.J., and P. Mohai. (2006). Environmentalism and contraceptive use: How people in less developed settings approach environmental issues. Population & Environment 27(1): 29-61.

Hox, J., R. vand de Schoot, and S. Matthijsse (2012). How few countries will do? Comparative survey analysis from a Bayesian perspective *Survey Research Methods* 6,2: 87-93

Little, R. J. A. and D. B. Rubin. (2002). *Statistical Analysis with Missing Data*. II Edition, New York: Wiley.

Maranghi, F. and Mantovani A. (2003). I contaminanti ambientali con effetti endocrini: problemi e prospettive. Notiziario dell'Istituto Superiore di Sanità. 16(5)

Morgan, S. P. (1981). Intention and uncertainty at later stages of childbearing: the United States 1965 and 1970. *Demography* 18(3): 267-285.

Morgan, S. P. (1982). Parity-specific fertility intentions and uncertainty: The United States 1970 to 1976. *Demography* 19(3): 315-334.

Morgan, S.P., Sobotka T. and M.R. Testa (Eds.) (2011). *Vienna Yearbook of Population Research. Special issue on Reproductive decision-making.* Vol.9. Vienna institute of Demography of the Austrian Academy of Sciences.

Namboodiri, K. (1972). Some observations on the economic framework for fertility analysis. *Population Studies* 26(2): 185-206.

Rayner, S. and E.L. Malone (eds) (1998). Human Choice and Climate Change: An International Assessment. Volume 1-4. Battelle Press, Columbus, Ohio.

Rendall, M. (2011). Breakup of New Orleans Households after Hurricane Katrina. *Journal of Marriage and Family*, 73, pp. 654-668

Skrondal, A. and Rabe-Hesketh, S. (2004). *Generalized Latent Variable Modeling: Multilevel, Longitudinal and Structural Equation Models*. Chapman & Hall/CRC.

Snijders, T. A. B. and R. J. Bosker. (1999). *Multilevel Analysis. An Introduction to Basic and Advanced Multilevel Modeling*. London: Sage Publications.

Stazi, A. and A. Mantovani (2001). Salute riproduttiva femminile e ambiente. Notiziario dell'Istituto Superiore di Sanità. 14(2)

Stegmueller, D. (2013). How many countries for multilevel modeling? A comparison of frequentist and Bayesian approaches" *American Journal of Political Science* 57, 3:748-761.

Swim, J. Clayton S., Doherty T., Gifford R., Howard G., Reser J. et al. (2009). *Psychology & global climate change: addressing a multifaceted phenomenon and set of challenges.* Whashington, DC: American Psychological Association.

Testa, M.R. (2012). Family size in Europe: evidence from the 2011 Eurobarometer survey. *European Demographic Research Paper* 1, Vienna Institute of Demography of the Austrian Academy of Sciences.

Testa, M.R., and A. De Rose. (2013). Cambiamento climatico e fecondità. *Newsletter Newodemos.*

Williams, R. (2006). Generalized ordered logit/partial proportional odds models for ordinal dependent variables. *The Stata Journal* 61(1): 58-82.

Yamaguchi, K. and L. R. Ferguson (1995). The stopping and spacing of childbirths and their birth-history predictors: rational-choice theory and event-history analysis. *American Sociological Review* 60(2): 272-298.

Table I Structure of the data: respondents aged 20 to 45 by country. EB 2011

	PARITY 0	PARITY 1	PARITY 2
Austria	174	75	103
Belgium	149	71	112
Bulagria	104	107	118
Cyprus	98	24	49
Czech republic	145	101	162
Denmark	122	57	93
Estonia	115	95	110
Finland	91	44	74
France	123	76	111
Germany	227	102	110
Greece	209	68	92
Hungary	130	95	119
Ireland	96	73	86
Italy	169	83	99
Latvia	151	147	122
Lithuania	141	82	109
Luxembourg	72	43	52
Malta	48	33	47
Netherlands	164	41	86
Poland	95	67	70
Portugal	119	99	94
Romania	135	126	98
Slovakia	125	89	135
Slovenia	137	67	84
Spain	177	86	118
Sweden	85	49	56
UK	155	96	117

Table II Description of the individual- and country-level variables used in the analysis. Women and men aged 20-45. Values in per cent.

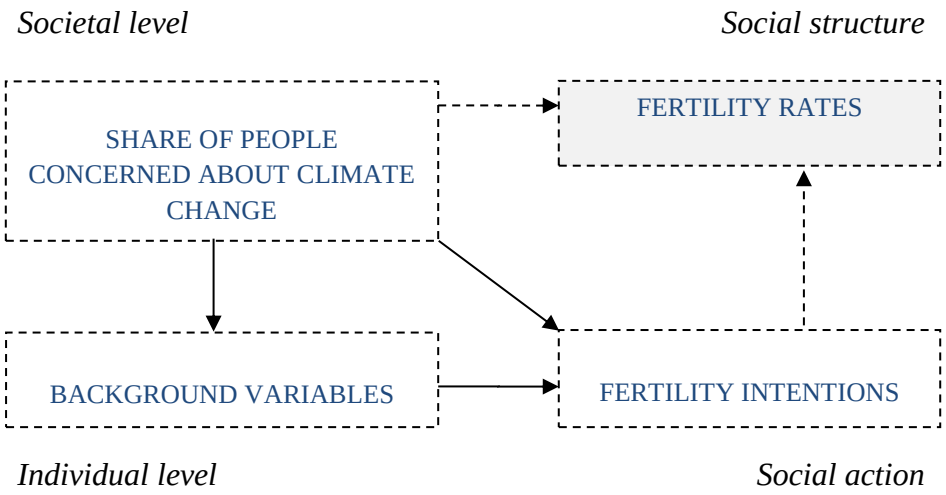
	PARITY 0	PARITY 1	PARITY 2
0 child intended	20	48	84
1 child intended	15	37	9
2 children intended	48	13	6
3 children intended	16	2	1
Age (average)	29	34	37
Male	55	38	39
Female	45	62	61
Climate change (strong) concerns	20	21	21
No climate change (strong) concerns	80	79	79
Married	19	64	75
Cohabiting	25	17	12
Single	54	10	5
Separated	2	9	8
Low education	5	10	12
Medium education	40	53	52
High education	35	36	35
Enrolled in education	20	1	1
Employed	64	74	76
Unemployed or inactive	36	26	24
Low self-positioning on the social scale	45	52	51
High self-positioning on the social scale	55	48	49

Table III Estimates from the ordinal regression model with random intercept on the additionally intended number of children. Women and men aged 20-45. Beta coefficients.

	Parity 0						Parity 1						Parity 2					
	Model I		Model II		Model III		Model I		Model II		Model III		Model I		Model II		Model III	
Climate change (Ref. No concern)																		
Concerns on climate change	-		0.00		0.00		-		0.20	+	0.19	+	-		0.12		0.12	
Individual-level variables																		
Age-33 (average)	-		-0.15	***	-0.15	***	-		-0.17	***	-0.17	***	-		-0.14	***	-0.14	***
(Age-33)^2	-		-0.01	***	-0.01	***	-		-0.01	***	-0.01	***	-		0.00		0.00	
Female (Ref.)	-						-						-					
Male	-		0.15	*	0.15	+	-		0.58	***	0.58	***	-		0.46	***	0.46	***
Married (Ref)	-						-						-					
Cohabiting	-		0.10		0.10		-		0.16		0.16		-		0.12		0.13	
Single	-		-0.10		0.10		-		-0.34	*	-0.34	*	-		0.23		0.23	
Separated	-		-0.25		-0.25		-		-0.85	***	-0.85	***	-		-0.04		-0.04	
Low education (Ref.)	-						-						-					
Medium education	-		0.08		0.09		-		0.27		0.27		-		0.16		0.17	
High education	-		0.28	+	0.28	+	-		0.83	***	0.82	***	-		0.60	*	0.61	*
Enrolled in education	-		0.74	***	0.74	***	-		1.40	**	1.40	**	-		1.87	***	1.89	***
Employed (reference)	-						-						-					
Unemployed or inactive			-0.40	***	-0.40	***			0.01		0.01				0.07		0.06	
Low pos. social scale (Ref.)	-						-						-					
High pos. social scale	-		0.30	***	0.30	***	-		0.26	**	0.26	**	-		0.44	***	0.44	***
Country-level variables																		
People concerned about climate change (%)	-				-0.90		-		-		0.43		-		-		-1.05	
First cutpoint	-1.47	***	-1.06	***	-1.25	***	-0.10		0.16		0.24		1.75	***	2.17	***	1.97	***
Second cutpoint	-0.67	***	-0.06		-0.24		1.77	***	2.51	***	2.60	***	2.67	***	3.19	***	2.99	***
Third cutpoint	1.63	***	2.53	***	2.35	***	3.86	***	4.73	***	4.81	***	4.41	***	4.99	***	4.79	***
Variance at the country level	0.16	***	0.12	***	0.12	***	0.16	***	0.11	***	0.11		0.32	***	0.28	***	0.27	***
Level-one: individuals	3556		3556		3556		2096		2096		2096		2626		2626		2626	
Level-two: countries	27		27		27		27		27		27		27		27		27	

(†p < .10; *p < . 05; ** p < .01; *** p < .001).

Figure I A micro-macro model of fertility



Source: inspired by Coleman 1990

Figure II Women and men of reproductive ages (20-45) who consider climate change a problem for the future. 27-EU countries. Values in per cent.

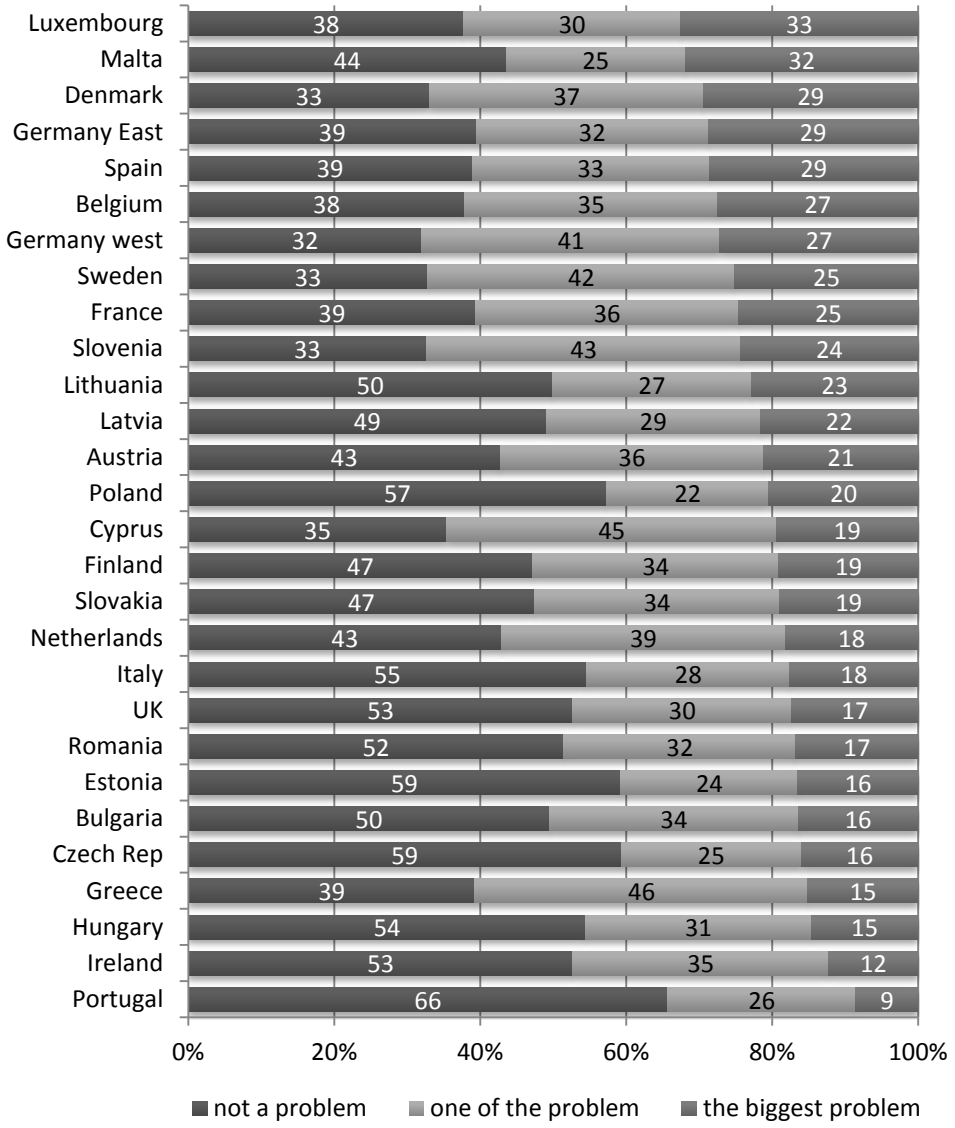


Figure III Mean ultimately intended family size decomposed in mean actual and mean additionally intended family size. Women of reproductive ages (20-45). 27-EU countries.