The future of low fertility: First results from a global survey of experts

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EXTENDED ABSTRACT

In Summer 2011 a global Internet survey on the likely future trends in fertility, mortality, and migration and the main factors behind them has been conducted among the members of major population associations and selected other professional organisations. The survey, organised as a collaboration of IIASA's World Population Program and Oxford University, will become a basis for new probabilistic population forecasts by age, sex, and level of education for most of the countries of the world and the provinces of India and China. By allowing a large number of experts to participate and by providing an argument-based underpinning of numerical estimates about future fertility trends, the survey addresses two common weaknesses of population projection-making: 1) a very limited or no theoretical foundation and 2) a participation of a small and often closed group of experts formulating the parameters of projection scenarios.

Our study will present first results of the survey module on low fertility, which addresses the future of fertility in countries that are relatively rich and have at present low fertility rates, as measured by the period total fertility rates (TFR) below or around the replacement threshold of 2.1. Instead of imposing one fixed fertility boundary for all countries, we applied a simple combination of two selection criteria in order to increase the cultural and economic similarity of the countries selected. This selection was based on relative affluence (measured by the UN Human Development Index for 2010) and fertility level (estimated TFR for the period 2005-10 by the United Nations World Population Prospects 2010). Applying a criterion of minimum development level threshold aimed to improve the match between the list of arguments, formulated mostly for relatively rich and non-traditional societies, and the list of countries corresponding to these criteria. The 85 selected countries and territories as well as the criteria applied are listed in Appendix 1. All other countries and territories recognised by the UN (100 in total) have been included in the "high fertility" module of the survey.

Countries in the "low fertility" module cover all Europe, North America, as well as much of Latin America, East Asia, and further include China, Iran, Thailand, Algeria, Australia, and New Zealand. The experts were offered a comprehensive list of 46 arguments potentially pertaining to the future trends in fertility (see Appendix 2 for their listing). These arguments were formulated to reflect all major theoretical perspectives, most common arguments as well as factors commonly identified in empirical studies on the determinants of fertility in contemporary advanced societies. The included arguments were carefully selected after repeated rounds of discussions between the scientists involved in designing the survey and selected other researchers. The arguments were clustered into six groups of factors: 1. Cultural and social forces in fertility ideals, norms and desires (9 arguments); 2. Partnerships and gender differences (9 arguments); 3. Role of policies (9 arguments); 4. Employment and economy (9 arguments); 5. Biomedical (7 arguments); 6. Education (3 arguments).

The experts have selected a country to which their assessment pertains, and also provided numerical estimates of the likely range of the period total fertility rates in 2030 and 2050. They could add additional countries or regions for which their assessment was valid as well.

In addition, they could also comment on the survey or on individual arguments.[1] Altogether, 184 questionnaires on the low-fertility module of the survey have been completed by more than 170 experts (some experts chose to make two or more assessments). These experts assessed 41 countries on 6 continents (when only the 'first-choice' countries are counted). The list of the 'first-choice' countries for which five or more experts completed the survey is shown in Table 1, together with the number of experts whose current residence or whose place of birth is in a given country. Altogether, for 14 countries five or more experts have provided their assessment, with the United States by far the most 'popular' (22 expert assessments), followed by China (14 assessments), Italy (12), and Germany (10). The table shows that a number of experts have assessed countries outside the most 'traditional' low-fertility regions of Europe, Northern America, Japan, Australia and New Zealand. Clearly, despite uneven coverage of some countries—with no expertise provided for France with a population of 64 million and 9 assessments for Sweden with a population of 9 million—the experts' assessments mirror quite well the wide geographical spread of low fertility today, with a particularly good coverage of China, Brazil, Japan, Mexico, as well as Iran. There are considerable differences between country of origin, country of residence and country of expertise for which the assessment has been made. On one hand, in several countries—e.g., Austria, Australia, France, and the United States—some of the resident experts decided to cover another country. On the other hand, there are countries where many assessments came from non-resident experts; this has been most notable for China (14 assessments, but only five resident experts), but it is also clearly apparent for Italy or Germany. It has to be noted, however, that the statistics of experts' country of birth and country of origin constitutes an undercount due to a large number of missing data (36 and 34, respectively).

Table 1
Top 10 countries with regard to experts' 'first-choice' selection and with regard to experts' country of residence and country of origin

Rank	Country	Number of assessments	Number of experts	
			By country of residence	By country of birth
1	United States	22	26	22
2	China	14	5	8
3	Italy	12	7	7
4	Germany	10	6	4
5	Sweden	9	6	5
6-9	Austria	7	9	5
6-9	Brazil	7	6	7
6-9	Iran	7	5	7
6-9	Spain	7	7	6
10-12	Czech Republic	6	2	5
10-12	Japan	6	3	4
10-12	Mexico	6	3	3
13-14	Australia	5	6	2
13-14	Turkey	5	4	4
	Not stated	*0*	*≤34*	*≤36*

[1] By and large, the experts have commented positively on the survey and its components. Many have also provided specific comments on items that were missing in their view in the list of arguments, on the relevance of the listed arguments for their country or region of expertise, or on the formulation of specific arguments.

We will cluster these countries into regions and analyse the responses along several key dimensions: numerical estimates of future period TFR, the relevance and impact of individual arguments, and the relative importance of the clusters of arguments. Additional analysis will be performed for selected most populous individual countries listed as 'first-choice' countries by five or more experts: China, the United States, Japan, Brazil, Iran, Turkey, Germany, and Italy. We will pay special attention to the arguments on the future trends and differentials in fertility by level of education and to the arguments where experts gave contrasting views about their likely importance and impact on future fertility. These diverging views either indicate existence of region-specific factors, or they signal considerable disagreement among scholars about the likely impact of some factors on future fertility trends.

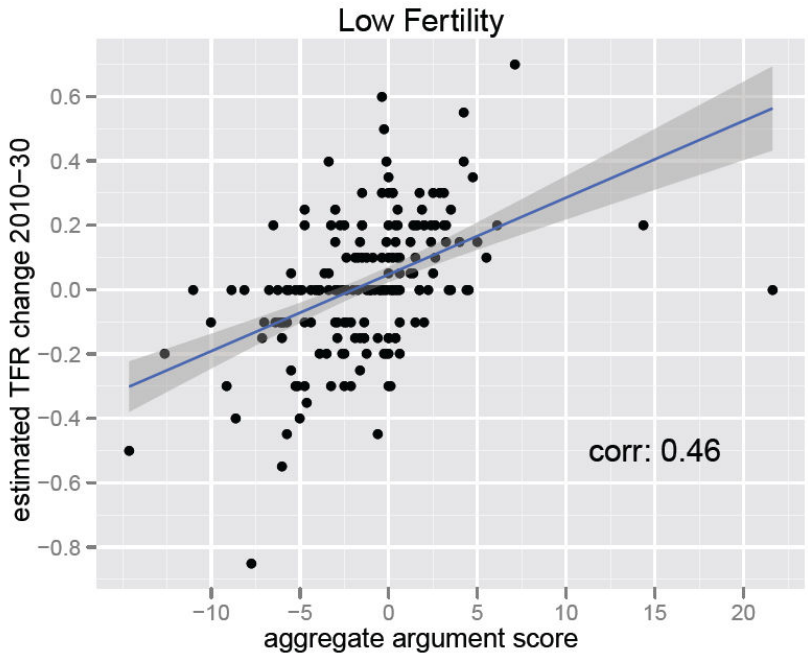
FIRST ANALYSES: SELECTED RESULTS AND ILLUSTRATIONS

In this section we show selected preliminary results of the survey, also to illustrate the richness of the dataset. We give one example showing the aggregate pattern of responses, one illustration of the diversity of answers to the expected impact of a selected argument on partnership instability, and one showing the expected fertility trends in China and the major forces behind them. This constitutes a preview that should be followed by a more systematic data analysis. Many more data layers, not shown here, await to be explored.

1 Global argument score

Figure 1 contrasts the aggregate argument score for each expert with their point (main) estimate of the expected change in the period total fertility rate (TFR) between 2010 and 2030. The aggregate argument score represents a summary measure of the likelihood that a given argument is right in combination with its envisioned impact on future fertility, computed for each expert across all 46 arguments. The more negative the score, the more arguments were suggested to have a negative impact on future fertility, and vice versa. Hence, it can be expected that the experts that reckoned that many of the factors assessed will negatively affect future fertility should also, on average, forecast that fertility levels will decline. And this 'internal logic' indeed clearly shows up in Figure 1, which depicts a good correspondence between the direction and the strength of the aggregate argument score on the one side and expected fertility change on the other side (correlation coefficient reaches 0.46).

Figure 1
Aggregate argument score and estimated TFR change in 2010-2030 (all low fertility countries combined)



2 Expected argument's validity and its likely impact on fertility

Some arguments elicited surprisingly differentiated reactions by the experts. This was clearly the case for the argument on partnership dissolution that belonged to the cluster of arguments on partnership and gender differences: "Partnership dissolution and re-partnering will become yet more common among women of reproductive age". As Figures 2 and 3a show, the experts reached a broad consensus that this trend is likely to take place; as many as 78% of experts thought that partnership dissolution

will become more common, as opposed to 6% who thought this statement is "more wrong than right"; not a single export chose the stronger answer, "very likely to be wrong". Hence our simple measure of experts' disagreement—ranging from 0 (all experts agree with the expected trends or with its supposed impact on fertility) and 1 (when experts are split half-half in their opinion)—reaches a very low value of 0.07. However, when it comes to the expected conditional impact of partnership instability on fertility, the experts' views are polarised, with almost as many experts expecting a negative influence (42) as is the number expecting a positive effect (48) (Figures 2 and 3b). In this case, the index of disagreement reaches a very high value of 0.88. Combining the envisioned direction of change with its conditional impact on fertility, a "net impact" on fertility (that could be adjusted by the experts themselves) provides a simple indication of the overall argument's importance. Again, experts' opinion was split, with a positive impact being expected slightly more frequently than the negative one, while the largest group representing one half of all experts, did not expect any net impact of increasing partnership instability on fertility (Figure 3c).

Figure 2
Argument's validity and its likely impact (all low fertility countries combined)

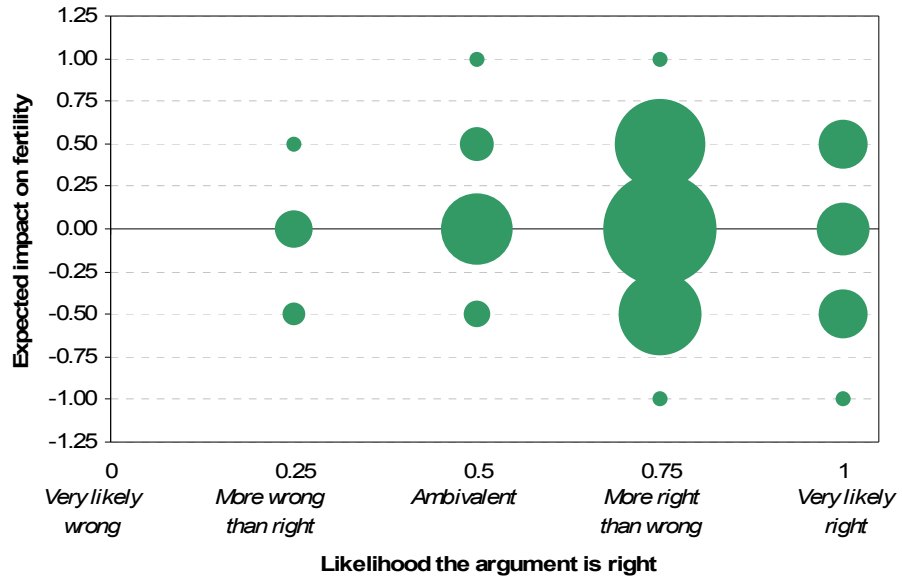
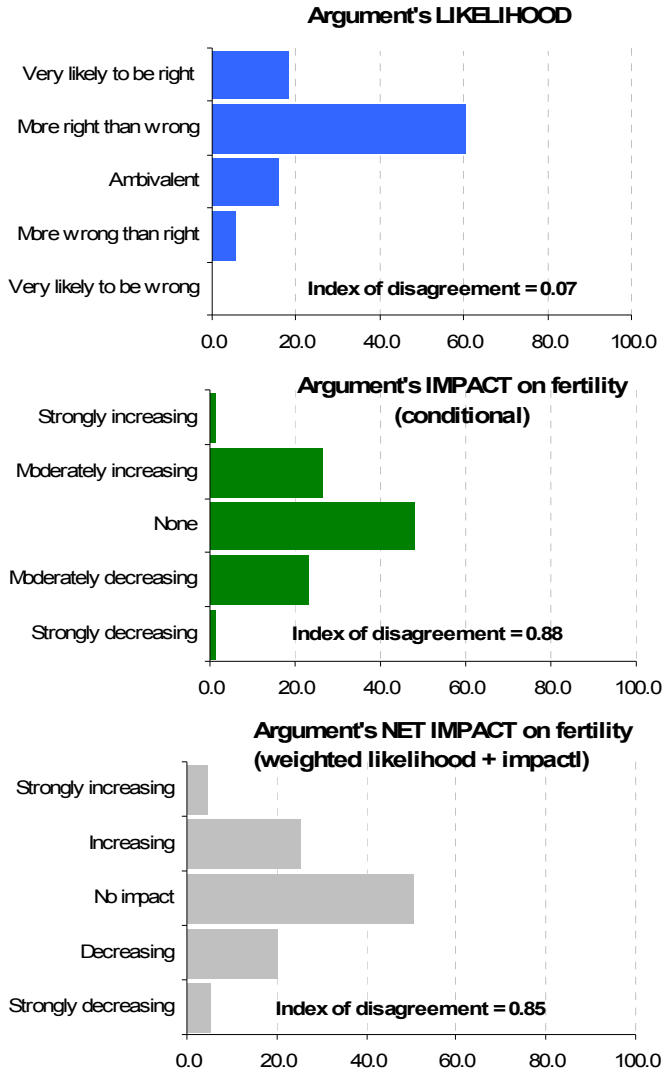


Figure 3a-c
Distribution of responses with regard to the arguments' likelihood of being true and its expected impact on future fertility



3 Selected results for China

China is by far the most important low-fertility country: given that 1.3 billion out of almost 3 billion people living in the "low fertility world" reside in China, global trends in low fertility will be strongly affected by fertility developments there. Our survey elicited enough assessments for China (14) to allow us conducting a separate analysis for this country. This analysis is all the more interesting if we consider that contemporary level of fertility in China is a puzzle that has been fuelling considerable debate in the last decade. Almost all experts and official estimates agree that Chinese fertility is well below replacement level, but the mainstream estimates of the recent total fertility rates broadly range between 1.2 and 1.8 (Zhao and Guo 2010, Zhao and Zhang 2010, Zhang and Zhao 2006, Morgan et al. 2009, Lutz et al. 2007), with the official (and incomplete) vital statistics often giving yet lower values.

Figure 4 shows the estimated influence of each of the six broad forces (clusters of arguments) on the future fertility by individual experts (mean values shown by enlarged red points). With the average weight of 31% (range between 10% and 70%), the cluster of cultural and social forces, including fertility ideals and norms, ranked as the most important for the future fertility trends in China. It was

followed by the role of policies (20%), clearly alluding also to the restrictive birth policies currently in force, and by the arguments related to employment and economy (17%).

Figure 4
Experts' opinion on the importance of selected broader forces (clusters of arguments) the future fertility trends in China

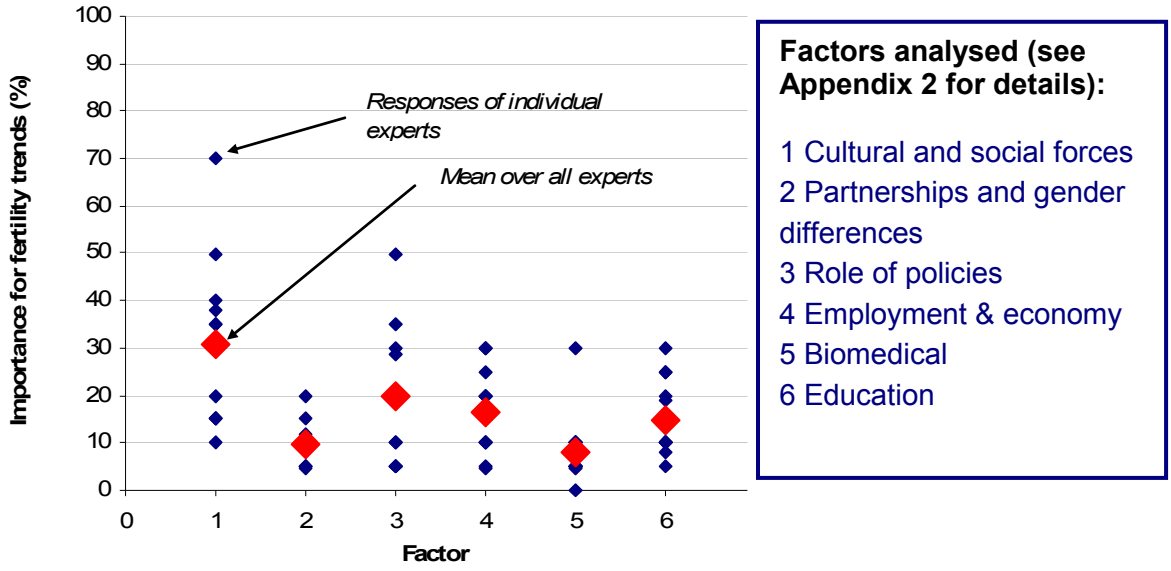


Figure 5 shows the expected fertility trajectories—featuring point (medium) estimates as well maximum and minimum values supposedly representing 80% interval of the likely future fertility distribution—based on the responses of 13 experts. Individual responses for the year 2050 are depicted in Figure 6 (the size of the data point represents the number of experts choosing a given fertility level). Our preferred estimates exclude the responses of experts that left the extreme initial "default" values of the minimum (0.2) and the maximum (3.35) total fertility rates unchanged. To emphasise the uncertainty about the initial (current) TFR level, two different estimates are shown: the estimate of 1.50 by the Population Reference Bureau for the year 2010 and the estimated value of 1.65 for the period of 2005-10 by the United Nations. The experts clearly and unanimously expect that the future fertility level in China will remain low. The mean of the point estimates declines to 1.41 in 2030 and remains at that level (1.42) also in 2050. Even when excluding the extreme low "default" values, the mean of the minimum estimates falls below 1 and reaches 0.93 by 2050, signalling that many experts can imagine an emergence of long-term extreme low fertility level in China. In contrast, only a few experts (2 when those keeping very high "default" values are excluded) think that even in a high scenario Chinese fertility can surpass the population replacement level of 2.1 in the coming decades. The mean of the "maximum" fertility level remains below 2 even by 2050. The envisioned "impossibility" of replacement-level fertility rates in the future is perhaps the most surprising outcome of the responses on China. This analysis also illustrates the value of expert opinion: in the case of China, experts' views contrast starkly with fertility scenarios in the global population projection produced by the United Nations (2010), where the medium variant projects a TFR of 1.81 in 2050-55 and the low variant of 1.31 comes close to our experts' "medium" average. Finally, Figure 7 shows the overall balance in the expected TFR change in the point estimate, suggesting that one half of experts expect a fertility decline between 2010 and 2030 (considering the TFR estimate of 1.50 in 2010), whereas in the long-run, there is a balance between positive and negative expectations.

Figure 5
Estimated means of point estimate, maximum and minimum value of the period TFR (80% confidence interval) in China in 2030 and 2050 (based on the responses of 13 experts)

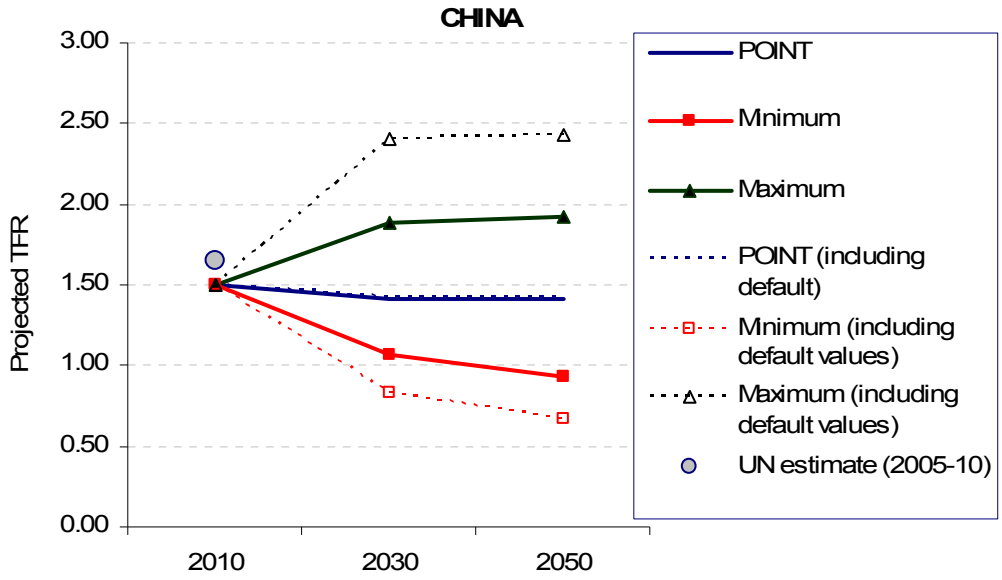


Figure 6
Estimated point, maximum and minimum value of the period TFR in China in 2050 (based on the responses of 9 experts, excluding predefined default values in the maximum and minimum estimates)

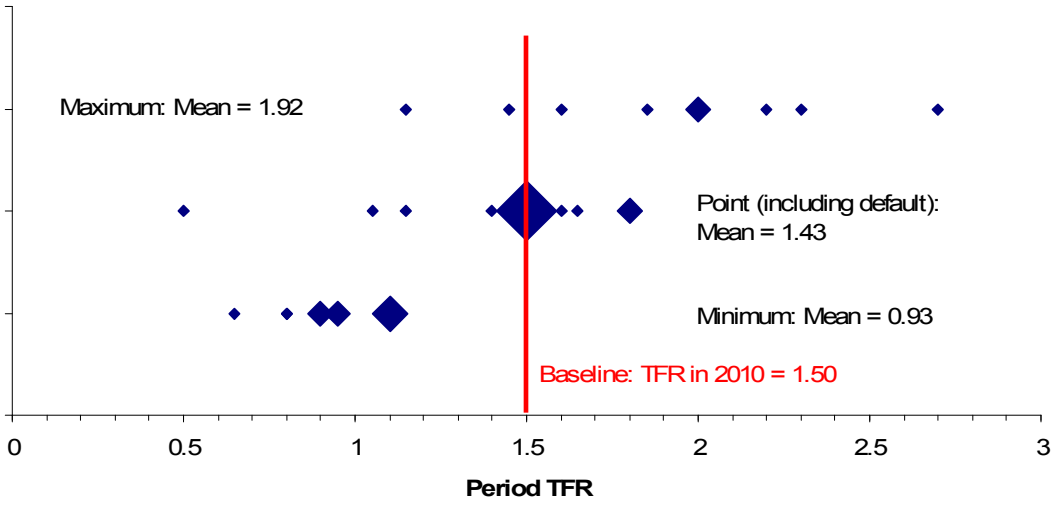
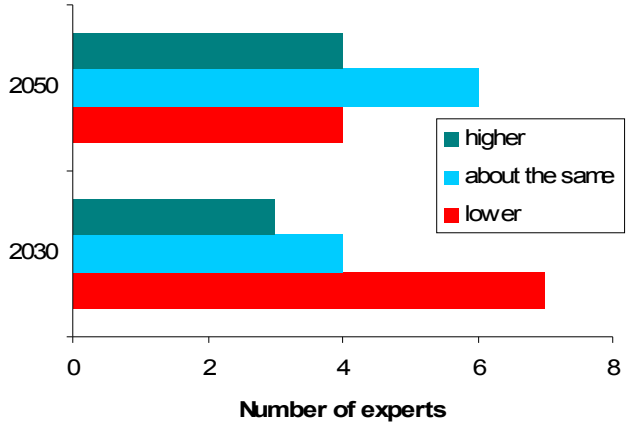


Figure 7
Expected change in the period TFR in China between 2010 and 2030 and between 2010 and 2050 (based on the responses of 14 experts, including predefined default values)



Appendix 1

Selection of countries into the „low fertility“ module

Two different sets of arguments pertaining to fertility have been formulated within the IIASA/Oxford project on argument-based global population projections: one for low-fertility settings with more advanced levels of development, and another for higher-fertility settings with lower level of development. This division is to some extent subjective, with a number of countries potentially falling on the border between the two groups. We used the period total fertility rates (TFR) estimated for the period of 2005-10 by the United Nations World Population Prospects 2010 and the UN Human Development Index (HDI) for 2010 to rank the countries by their levels of fertility and development.[2]

The following criteria were used to divide countries into the "Low fertility, higher development" (LOWFERT, 85 countries and territories) and "Higher fertility, lower development" (HIGHFERT, 100 countries and territories) groups:

The LOWFERT group includes:

- Countries with sub-replacement period fertility (TFR below 2.10) and moderate or high level of development (HDI at 0.650 or higher). Only three countries with a TFR below 2.10 had a HDI level below 0.65 (Maldives, Myanmar and Vietnam)
- Countries with moderate period fertility (TFR between 2.10 and 2.49) and higher level of development (HDI at 0.670 or above). The following countries with the TFR between 2.10 and 2.49 were included: Brunei, New Zealand, Uruguay, Turkey, Azerbaijan, Argentina, Kuwait, Algeria, Mexico, Jamaica, Qatar, and Colombia;
- Countries with moderate period fertility (TFR between 2.10 and 2.49) and unknown level of Human Development Index (which has not been computed for them). The following countries and territories with the TFR between 2.10 and 2.49 were included: Guadaloupe, French Polynesia, New Caledonia, and Réunion;
- Countries with higher period fertility (TFR at 2.50 or above) with very high level of development (HDI above 0.85). Only one country, Israel, was included on that count.

All other countries fall into the HIGHFERT group, which therefore comprises:

- All countries with the TFR at 2.50 or above except Israel;
- Countries with the TFR between 2.10 and 2.49 and HDI below 0.670: Indonesia, Guyana, Salvador, Sri Lanka, Morocco, Bangladesh, Suriname, and Uzbekistan;
- Three countries with a TFR below 2.10 with low HDI values (below 0.65): Maldives, Myanmar and Vietnam

Table A1 below ranks all the countries by their TFR (ranking from the lowest fertility up) and lists their TFR in 2005-10, their Human Development Index (HDI) in 2010 and their distribution into the low or high fertility module of the survey.

[2] Note that the series of the period TFR used for this selection differed from the estimates of the period TFR used in the survey to provide the initial TFR level for all countries in 2010. For the latter purpose, the more recent (2010) estimates published by Population Reference Bureau (2010, http://www.prb.org/pdf10/10wpds_eng.pdf) have been used. However, the division of countries into the higher and lower fertility groups would remain identical if the PRB data were used instead of the UN estimates.

Table A1

Country ranking by the period TFR in 2005-10 (from the lowest level up) and their inclusion into the "low fertility" module of the IIASA-Oxford argument-based global population projections (only countries with the TFR below 2.50 and Israel are listed; countries included in the "high fertility" module are shown in italics)

	Country	Period TFR (UN) 2005-10	HDI, 2010	Fert. Mod.		Country	Period TFR (UN) 2005-10	HDI, 2010	Fert. Mod.
1	Hong Kong SAR	0.99	n.a.	Low	50	Finland	1.84	0.871	Low
2	Macao SAR	1.02	n.a.	Low	51	Denmark	1.85	0.866	Low
3	Bosna-Herzegovina	1.18	0.710	Low	52	United Arab Emirates	1.86	0.815	Low
4	Singapore	1.25	0.846	Low	53	Lebanon	1.86	n.a.	Low
5	Slovakia	1.27	0.818	Low	54	*Vietnam*	*1.89*	*0.572*	*High*
6	Republic of Korea	1.29	n.a.	Low	55	Sweden	1.90	0.885	Low
7	Poland	1.32	0.795	Low	56	Brazil	1.90	0.699	Low
8	Japan	1.32	0.884	Low	57	Chile	1.90	0.783	Low
9	Malta	1.33	0.815	Low	58	*Maldives*	*1.90*	*0.602*	*High*
10	Romania	1.33	0.767	Low	59	Bahamas	1.91	0.784	Low
11	Hungary	1.34	0.805	Low	60	Martinique	1.91	n.a.	Low
12	Germany	1.36	0.885	Low	61	Costa Rica	1.92	0.725	Low
13	Portugal	1.36	0.795	Low	62	Norway	1.92	0.938	Low
14	Italy	1.38	0.854	Low	63	Australia	1.93	0.937	Low
15	Austria	1.38	0.851	Low	64	France	1.97	0.872	Low
16	Slovenia	1.39	0.828	Low	65	Netherlands Antilles	1.98	n.a.	Low
17	Belarus	1.39	0.732	Low	66	Tunisia	2.04	0.683	Low
18	Ukraine	1.39	0.710	Low	67	North Korea	2.05	n.a.	Low
19	Czech Republic	1.41	0.841	Low	68	U.S.A.	2.07	n.a.	Low
20	Lithuania	1.41	0.783	Low	69	*Myanmar*	*2.08*	*0.451*	*High*
21	Spain	1.41	0.863	Low	70	Ireland	2.10	0.895	Low
22	Latvia	1.41	0.769	Low	71	Iceland	2.10	0.869	Low
23	Croatia	1.42	0.767	Low	72	Brunei	2.11	0.805	Low
24	Russian Federation	1.44	0.719	Low	73	Uruguay	2.12	0.765	Low
25	Bulgaria	1.46	0.743	Low	74	New Zealand	2.14	0.907	Low
26	Switzerland	1.46	0.874	Low	75	Guadeloupe	2.14	n.a.	Low
27	Greece	1.46	0.855	Low	76	Turkey	2.15	0.679	Low
28	Macedonia	1.46	n.a.	Low	77	Azerbaijan	2.16	0.713	Low
29	Cuba	1.50	n.a.	Low	78	French Polynesia	2.16	n.a.	Low
30	Republic of Moldova	1.50	n.a.	Low	79	*Indonesia*	*2.19*	*0.600*	*High*
31	Cyprus	1.51	0.810	Low	80	New Caledonia	2.19	n.a.	Low
32	Barbados	1.53	0.788	Low	81	Argentina	2.25	0.775	Low
33	Georgia	1.58	0.698	Low	82	Kuwait	2.32	0.771	Low
34	Albania	1.60	0.719	Low	83	*Guyana*	*2.33*	*0.611*	*High*
35	Luxembourg	1.62	0.852	Low	84	*Salvador*	*2.35*	*0.659*	*High*
36	Serbia	1.62	0.735	Low	85	*Sri Lanka*	*2.36*	*0.658*	*High*
37	Thailand	1.63	0.654	Low	86	*Morocco*	*2.38*	*0.567*	*High*
38	Estonia	1.64	0.812	Low	87	*Bangladesh*	*2.38*	*0.469*	*High*
39	China	1.64	0.663	Low	88	Algeria	2.38	0.677	Low
40	Trinidad and Tobago	1.64	0.736	Low	89	Réunion	2.40	n.a.	Low
41	Canada	1.65	0.888	Low	90	Jamaica	2.40	0.688	Low
42	Mauritius	1.67	0.701	Low	91	Qatar	2.40	0.803	Low
43	Montenegro	1.69	0.769	Low	92	Mexico	2.41	0.750	Low
44	Armenia	1.74	0.695	Low	93	*Suriname*	*2.42*	*0.646*	*High*
45	Netherlands	1.75	0.890	Low	94	Colombia	2.45	0.689	Low
46	Iran	1.77	0.702	Low	95	*Uzbekistan*	*2.46*	*0.617*	*High*
47	Belgium	1.79	0.867	Low	…	…		…	…
48	Puerto Rico	1.83	n.a.	Low	119	Israel	2.91	0.872	Low
49	United Kingdom	1.83	0.849	Low					

Appendix 2

Complete list of arguments and their groupings by major factors in the low fertility module of the IIASA-Oxford survey

1. Cultural and social forces in fertility ideals, norms, and desires

1.1 Voluntary childlessness is increasingly becoming socially accepted
1.2 One-child families will become a dominant cultural norm
1.3 Society will become yet more individualistic
1.4 It is a human constant that people will always desire at least one surviving child in order to 'continue living' in the future
1.5 The share of population groups with larger families will increase
1.6 The availability of grandparents for childcare and family care will decline
1.7 Religious views on family and reproduction will gain importance
1.8 High fertility will become a status symbol among the wealthy.
1.9 Globally, there will be a convergence of all populations towards a two-child family as an ideal and actual family size.

2. Partnerships, living arrangements and gender differences

2.1 Men are increasingly reluctant to become fathers, even when they live with a partner
2.2 Men and women will increasingly share the burden of housework and childcare
2.3 People are increasingly unable to find the right partner to form a family
2.4 Women will increasingly pursue lifestyles and activities not compatible with motherhood
2.5 Marriage will further decline and will become a minority experience
2.6 Partnership dissolution and "re-partnering" will become yet more common among women of reproductive age
2.7 Women will achieve complete equality with men with respect to their education, employment career, and income
2.8 Cross-border partnership and marriage migration will increase in importance
2.9 Adults in their 20s and even 30s will spend ever longer periods of life living with their parents

3. Role of Policies (In this case, 'Government' entails national government unless stated otherwise)

3.1 Government will raise child subsidies and tax benefits or introduce birth bonuses
3.2 Government will take an increasingly pro-natalist stance (e.g. through communication campaigns and family policies)
3.3 Government will provide universal nursery / kindergarten access
3.4 Provision of affordable housing for families and young adults will become an important part of social policies
3.5 New policies will allow young parents to significantly reduce their working hours for several years with some compensation of income
3.6 Mothers will be increasingly expected and encouraged to return to work even when their children are small
3.7 Family-related policies, including childcare provision, will be increasingly pursued by local governments and employers
3.8 Governments will cut back on family support when economic conditions worsen.
3.9 As populations age government funds will become increasingly directed toward the elderly and away from the young.

4. Employment and economy

4.1 Unemployment and job instability among the under-30s will further increase
4.2 Increasing average household income will lead to higher fertility
4.3 Employers will put more pressure on their employees in terms of higher working hours and more work commitments

4.4 Work practices will become more flexible in the future (e.g. telecommuting, working from home, flexi-time, part-time)
4.5 Geographical mobility, especially work-related, will further increase
4.6 Immigration from high fertility countries will increase
4.7 Continuing economic unpredictability will make individual life-course planning ever more uncertain
4.8 Informal childcare will shift from grandparents to paid domestic workers
4.9 Cities will become more child-friendly

5. Biomedical and the timing of parenthood

5.1 Men are becoming less fecund due to declining sperm counts or quality
5.2 Delayed childbearing will become yet more common among women
5.3 Having children under the age of 25 will be rare
5.4 The broad availability and use of efficient contraception, including post-coital methods, will make mistimed and unwanted pregnancies rare
5.5 Financial, normative and institutional barriers to Assisted Reproductive Technologies (ART) will keep their application limited
5.6 Assisted reproduction and selective abortion will be increasingly used to achieve a desired sex composition as well as other characteristics of children.
5.7 The technology and availability of ART will improve sufficiently that women in their forties who want a child will routinely be able to have one.

6. Education

6.1 People will spend ever more years of their young adult life enrolled in education and professional training on the job
6.2 Fertility differentials by level of female education will diminish.
6.3 There will be a new trend for better educated women to have more children and simultaneously pursue a professional career.