WORKING PAPER

COMPARATIVE ANALYSIS OF COMPLETED PARITY DISTRIBUTIONS: A GLOBAL WFS-PERSPECTIVE

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IIASA
International Institute for Applied Systems Analysis

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Foreword

The IIASA Population Program has turned out a number of studies of distributions, in contrast to the averages to which standard demographic analysis is largely confined. James Vaupel and Anatoli Yashin have shown that the degree to which individuals of a given age differ (for instance in their chances of dying) makes a substantial difference in the conclusions to be drawn from mortality tables.

The present work carries this concern with heterogeneity into a further domain: the variation among women in the number of children born to them. If all women have three children the population will increase at exactly the same rate as if half of the women have six children and the others have none (mortality and migration being the same). But many other things will be different, all the way from participation in the labor force to the pattern of housing demand.

Of the many ways in which distributions can be described Wolfgang Lutz leans heavily on a set of statistics that come close to describing behavior: the fraction of married women who have at least one child; the fraction of those with one child who go on to have a second; and so on. These parity (from a Latin root meaning childbearing) progression ratios would be 1,1,1,0,0,0,0,... for the population in which all women have three children; 0.5,1,1,1,1,1,0,0,0,... for the population in which half have six children and the other half have none. In the more typical case the parities start close to unity, and after one or two children go down because of disinclination or the biological incapacity to bear. An example is Czechoslovakia, with 0.96,0.83,0.43,0.39,0.36, etc.

The source of information here is the World Fertility Survey, with its completed family size for ever-married women in 55 countries.

One might have thought that under natural fertility, when no one was controlling, most women would have about the same number of children, and on the other hand when women were free to choose the number of their children some would want few, some would want many, so the variation would be great. This is exactly what does not happen with the passage from natural to controlled childbearing; in the former case variation is considerable and in the latter people use birth control to have close to two children. The tables of this Working Paper narrow variation for 14 developed countries, and much greater variation for most of the 41 less developed countries.

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Wolfgang Lutz

1. INTRODUCTION

Like any other distribution, the distribution of children ever born to a cohort of women may be characterized by its moments. While the first moment—the mean parity or mean family size—has been playing a central role in almost every kind of demographic fertility analysis, the variance or other distributional aspects of fertility have received little attention so far. One reason for this overwhelming dominance of the mean might also lie in the fact that it represents a link between the two major approaches of demographic analysis: cohort and period analysis. The construction of a synthetic cohort through adding up all age-specific fertility rates observed in a period results in a mean number of children implied by period rates (the TFR) that is isomorphic to the first moment of the completed parity distribution of a cohort. Hence conventional period fertility analysis can give us the mean family size of a synthetic cohort but not the family size distribution itself. The estimation of period completed parity distribution requires more sophisticated models based on parity-specific fertility rates.[1]

Yet for many purposes the mean family size will suffice as an indicator of fertility. For a population projection that only attempts to forecast the sizes of age groups in a certain year in the future, all that matters is the number of persons in a cohort which depends only on the average birth intensities and not on other aspects of the distribution of children over women. But already when trying to discuss the plausibility of certain assumptions of average fertility we have to go back to the level of individual behavior, and there couples do not have average family sizes but a certain discrete number of children. At that level of analysis every change in the average level of fertility has to be understood

[1] See e.g. G. Feeney, 'Population dynamics based on birth intervals and parity progression', *Population Studies*, 37, 1 (1983), pp. 75–89; C. Chiang, *The Life Table and Its Applications* (Robert E. Krieger Publishing Co., Malabar, Florida, 1984); W. Lutz and G. Feichtinger, 'A life table approach to parity progression and marital status transitions', contributed paper to the IUSSP General Conference (Session F.13) in Florence (1985).

as the sum of individual behavior, as the result of many more or less conscious decision-making processes for a certain family size. There is no reason to assume that a change in the mean level would leave the shape of the distribution unchanged. On the contrary, the subsequent analysis will show that there are strong and characteristic changes in the shape of the distribution associated with observed trends in the average family size.

Historically, a lack of information on parity distributions was probably the other major reason for the disregard of distributional aspects in fertility analysis. Even the change from natural to controlled fertility which is by definition a parity-specific phenomenon had to be studied indirectly through the comparison of shapes of age-specific marital fertility schedules.[2] The success of this method is largely based on the strong positive correlation between age and parity. Systematic attempts to estimate the extent of fertility control directly from cohort parity distributions are much rarer.[3]

The World Fertility Survey provides a very rich and reasonably reliable source material for parity-specific fertility analysis. And yet among the hundreds of WFS-based publications very few studies have been made in this field[4] and none has tried to combine the results from high and low fertility countries. The analysis in this paper is based on WFS standard recode files for 41 less developed countries[5] (compiled by WFS headquarters in London) which were combined with the WFS files for 14 European countries and the US (centrally collected at the UN-ECE in Geneva).[6] In this paper we focus only on completed cohort distributions of ever-married women. Since the highest age considered

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[2]This indirect measurement approach was introduced by A. Coale, 'Age patterns of marriage', *Population Studies* (1971), pp. 132–214, and further developed by A. Coale and J. Trussell, 'Model fertility schedules: variations in the age structure of childbearing in human populations', *Population Index*, **40** (1974), pp. 185–258 (see also Erratum, *Population Index*, **41**, p. 572); and A. Coale and J. Trussell, 'Technical note: finding the two parameters that specify a model schedule of marital fertility', *Population Index*, **44** (1978), pp. 203–213.

[3]Recently P. David, T. Mroz, W. Sanderson, K. Wachter, and D. Weir, 'Cohort parity analysis: statistical estimates of the extent of fertility control', *Demography*, **25**, 2 (1988), p. 163–188, suggested a model of cohort parity analysis (CPA) that measures the extent and timing of the adoption of fertility control within marriage. Before that D.V. Glass and E. Grebenik, *The Trend and Pattern of Fertility in Great Britain: A Report on the Family Census of 1946* (Part I: Report, Papers of the Royal Commission on Population, Vol. 6) (London: Her Majesty's Stationery Office, 1954); and J. Matras, 'Social strategies of family formation: data on British female cohorts born 1831–1906', *Population Studies*, **19** (1965), pp. 167–181, have used model parity distributions to compare different fertility regimes.

[4]Some of the WFS-based publications that explicitly consider parity distributions are: J. Hobcraft and J. McDonald, 'Birth intervals', *WFS Comparative Studies No. 28* (Voorburg: International Statistical Institute, 1984); M. Hodgson and J. Gibbs, 'Children ever born', *WFS Comparative Studies No. 12* (Voorburg: International Statistical Institute, 1980); and W. Lutz, 'Parity-specific fertility analysis: a comparative analysis on 41 countries participating in the World Fertility Survey (Vienna: Demographic Institute of the Austrian Academy of Sciences, 1985).

[5]For some reason Portugal was treated as an LDC by WFS, although its fertility level was lower than those in Spain, Yugoslavia, and the USA.

[6]The author is grateful to WFS and ECE authorities for having had the opportunity to use the data sets in London and Geneva.

was 49 in most countries (only 45 in most European countries) we had to consider all women above age 40 as having essentially completed their reproductive career in order to have sufficiently large samples. The restriction to ever-married women had become necessary for consistency because in a large number of countries only ever-married women had been interviewed. The only two socio-economic background variables considered here are place of residence (urban/rural) and education (low/high) according to standard WFS conventions.

The descriptive tool used in this study to analyze the empirically observed completed parity distributions of cohorts and the underlying set of parity progression ratios is the deterministic trunk model of the fertility table based on parity introduced by Chiang and van den Berg[7] and modified by Feichtinger and Lutz.[8] This model that has originally been designed for period analysis to estimate the completed parity distribution implied by observed period parity-specific fertility rates and mean ages at birth also turned out to be a powerful tool for the purely descriptive analysis of completed cohort fertility. This is especially true for a detailed analysis of the timing of parity progression when conditional mean ages at births of given orders are considered.[9] But also in the context of this comparative study that is only concerned with the quantum aspect of reproduction, the basic functions of the fertility table based on parity seem to be a useful descriptive tool.

The fertility table is essentially built up in analogy to an ordinary (mortality) life table where parity replaces age as the indexing variable. The parity progression ratios then correspond to the survival probabilities; their complements—the probabilities of death in the ordinary life table—give the probabilities of dropping out of the process of parity progression at a certain parity. Starting with a radix, $l(0)$, of 1000 women entering the reproductive age, the $l(i)$ column then gives the proportion of women that "survived" to parity i, or, in other words, that made it up to i or more children. Hence, like in a regular life table, $l(i)$ is defined by

$$l(i) = l(i-1)p(i-1)$$

[7] C.L. Chiang and B.J. van den Berg, 'A fertility table for the analysis of human reproduction', *Mathematical Biosciences*, **62** (1982), pp. 237-251.

[8] G. Feichtinger and W. Lutz, 'Eine Fruchtbarkeitstafel auf Paritätsbasis', *Zeitschrift für Bevölkerungswissenschaft*, **9**, 3 (1983), pp. 363-377. A sensitivity analysis of the model with respect to age-distributional effects was conducted by W. Lutz and G. Feichtinger, 'Altersstruktureffekte bei der Schätzung der Schliesslichen Paritätsverteilung (Age-Structural Effects in the Estimation of Completed Parity Distributions), *Festschrift für Karl Schwarz* (1988), forthcoming (in German).

[9] Within the concept and notation of this model data on mean ages at birth of certain orders broken down by completed parity can be used to calculate correct birth intervals (and avoid the mistake of comparing the crude mean ages that refer to different groups of women) and several measures of the family life cycle such as the mean duration from birth of order i to completion of family size. For a more detailed description of this see Lutz and Feichtinger, *op. cit.*, in footnote 1.

where $p(i)$ is the parity progression ratio at parity i. The column of life table deaths, $d(i)$, then gives the proportion of women that drop out of the process of parity progression at that parity and hence remain at parity i. Again in analogy to the regular life table $d(i)$ is defined by

$$d(i) = l(i)(1-p(i)) \quad \text{or} \quad d(i) = l(i) - l(i+1) \quad .$$

Empirically this descriptive form of the fertility table pertaining to a cohort is entered through the $d(i)$-column which corresponds directly to the observed completed parity distribution (multiplied by the radix). Once the $d(i)$ column is given, the $l(i)$ and $p(i)$-columns can be derived by simple algebraic transformations according to the definitions given above.

Table 1. Descriptive parity table: Kenya, women aged 40–49.

i	$p(i)$	$l(i)$	$d(i)$	$F(i)$
0	.9684	1000	31	7.74
1	.9751	968	24	6.77
2	.9753	944	23	5.83
3	.9657	920	31	4.91
4	.9628	889	33	4.02
5	.9341	856	56	3.16
6	.8937	799	85	2.36
7	.8347	714	118	1.65
8	.7541	596	146	1.05
9	.6555	449	155	.60
10	.5510	294	132	.31
11	.5185	162	78	.14
12	.4375	84	47	.06
13	.3878	36	22	.02
14	.3158	14	9	.01
15+		4	4	

Table 1 gives an example of the cohort fertility table for Kenya. In addition to the $p(i)$, $l(i)$, and $d(i)$ columns discussed above it is also possible to calculate the mean number of children born beyond parity i, $F(i)$, directly from the given data by

$$F(i) = \sum_{x=i+1}^{m} f(x) \quad \text{where}$$

$$f(i) = l(i)/l(0) \quad ,$$

m being the highest parity considered. The quantity $f(i)$ gives the number of births of order i per woman. It is equivalent to what Ryder[10] calls the total fertility rate for births

[10]N. Ryder, 'Progressive fertility analysis', *WFS Technical Bulletins No. 8*, p. 41 (Voorburg: International Statistical Institute, 1982).

of order i. Clearly the summation over all $f(i)$'s which is equal to $F(0)$ is the mean number of children born by the cohort (considering births of all parities).[11] Every mention of mean parity or mean family size of a cohort in the following sections will refer to this quantity $F(0)$.

2. COMPARATIVE DESCRIPTION OF COMPLETED PARITY DISTRIBUTIONS

Table 2 gives the observed distributions of children ever born to ever-married women aged 40–49 in all 54 less and more developed WFS countries with standard recode files available. Since most WFS surveys took place around the middle of the 1970s and at that point the observed cohorts of women were already past their prime childbearing ages, the given parity distributions do not reflect very recent fertility patterns but rather those of (on average) two to three decades ago. Table 2 presents the completed parity distributions that were used as input data to the following analysis.

From Table 2 itself differential shapes of the distribution do not become very clear at first sight. What can be seen is that in Cameroon the proportion of childless women is exceptionally high with over 15%; this proportion is lowest in the Republic of Korea with 1.5%. The mode of the completed parity distribution ranges for high-fertility countries mostly between six and nine children, whereas in all European countries it lies at parity two. Some countries such as Benin and Jamaica show bi-modal distributions. In Paraguay and Nigeria the modes are exceptionally low (at parities three and four, respectively) by the standards of high-fertility countries. Costa Rica has the highest proportion of women with 15 or more births (3.4%) followed by Jordan (2.4%) and Mexico (2.1%).

The mean family size of the cohort considered ($F(0)$) is also given in Table 2. It is highest in Jordan (8.66) followed by Kenya (7.73) and Syria (7.66) and lowest in Czechoslovakia (2.34), leaving out the Netherlands (1.67), because the Dutch data are not strictly compatible due to the selection of cohorts in the study.[12] Among the more developed countries average family sizes are highest in the USA (3.48) and Spain (3.10). These values seem rather high by current period TFR standards because they refer to ever-married women only and the cohorts covered are those that mostly had their prime childbearing during the period of the post-war baby boom. From Table 2 we see also

[11] To account for the fact that some women in the $m+$ category have more than m children, the mean of this category was assumed to be $m+1$ in our calculations.

[12] In this context the Dutch data are not strictly comparable to the other countries because they are restricted to the marriage cohorts 1963–1973.

Table 2. $D(i)$ for all countries.

Country	F(0)	Completed parity distribution (per 1000) 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AFRICA																	
Benin	6.14	32	25	62	70	105	89	120	143	141	106	51	38	9	3		
Cameroon	4.91	154	96	71	76	62	71	89	101	92	78	43	30	17	6	4	1
Egypt	6.64	38	32	45	48	72	104	118	131	118	103	91	38	31	11	7	5
Ghana	6.38	23	19	51	66	94	99	134	138	135	110	77	32	5	9	0	
Ivory Coast	6.78	40	51	42	43	62	76	96	107	135	146	82	71	22	10	6	2
Kenya	7.73	31	24	23	31	33	56	85	118	146	155	132	78	47	22	9	4
Lesotho	5.22	52	71	94	99	103	101	118	114	97	73	40	15	12	5		
Mauritania	6.01	47	48	70	83	89	102	100	125	76	106	54	42	36	10	4	
Morocco	7.08	69	37	39	40	47	57	95	97	124	119	108	63	57	20	11	9
Nigeria	5.41	73	53	73	94	114	107	108	101	88	74	54	27	20	14		
Senegal	6.92	35	40	43	46	71	68	85	117	139	128	95	88	35	6		
Sudan	6.00	75	50	67	66	69	76	96	118	130	87	89	44	21	5		
Tunisia	6.78	36	21	29	48	71	106	126	133	123	133	72	47	30	9	7	0
AMERICAS																	
Colombia	6.90	28	38	55	86	84	91	83	94	93	77	80	70	39	29	26	18
Costa Rica	6.92	28	35	71	105	89	72	88	76	80	72	68	54	58	42	20	34
Dominican Rep.	6.39	49	60	58	78	109	80	102	58	84	73	64	75	58	37	8	
Ecuador	6.98	18	26	58	74	94	97	96	96	97	96	72	57	50	32	14	18
Guyana	6.46	54	64	46	73	65	84	101	98	103	93	77	47	47	22	12	7
Haiti	5.80	34	61	61	87	101	110	114	108	110	97	62	34	11	3		
Jamaica	5.51	73	86	91	73	106	82	74	101	97	60	60	39	34	12	10	4
Mexico	7.03	37	37	55	61	76	82	91	97	94	107	75	61	46	37	16	21
Panama	5.74	33	41	91	106	102	134	105	95	83	55	59	43	31	10	4	
Paraguay	6.27	29	74	122	208	95	107	86	56	71	44	35	32	26	8		
Peru	6.76	22	35	51	82	86	92	104	107	98	97	71	60	47	19	10	11
Trinidad & Tobago	5.50	58	66	78	104	110	97	117	90	85	50	48	36	29	20	3	
USA	4.48	57	72	228	233	152	115	54	36	21	15	12	2	2	1		
Venezuela	6.21	20	43	102	84	99	104	93	99	67	78	81	61	34	17	11	

Table 2. Continued.

Country	F(0)	Completed parity distribution (per 1000)															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ASIA AND PACIFIC																	
Bangladesh	6.95	25	27	40	55	49	87	112	153	128	127	87	51	30	10	7	4
Fiji	6.31	51	39	55	69	69	100	111	124	114	94	77	45	21	8	7	8
Indonesia	5.25	66	84	83	91	94	98	114	105	97	64	44	32	17	3	1	
Jordan	8.66	23	9	21	27	43	42	74	90	87	141	136	111	73	61	32	24
Korea	5.42	15	38	48	77	147	187	167	149	95	39	20	9	3	1		
Malaysia	6.13	29	50	68	88	95	103	103	109	101	84	70	47	28	8	5	5
Nepal	5.65	39	36	76	73	127	123	119	131	107	87	42	21	10	3		
Pakistan	6.91	36	28	35	50	57	87	97	149	141	117	95	47	32	13	5	3
Philippines	6.86	24	31	43	66	81	87	111	107	112	119	90	55	34	20	6	6
Sri Lanka	5.73	36	52	76	89	98	104	140	117	90	78	50	35	14	8	3	1
Syria	7.66	36	13	23	41	44	72	108	104	139	114	106	83	54	26	16	12
Thailand	6.36	25	40	56	69	99	101	116	118	106	100	76	36	27	11	5	5
Turkey	6.08	27	17	76	102	117	129	100	112	81	82	56	40	25	12	10	5
Yemen	6.65	21	23	38	71	95	109	109	128	128	100	66	59	28	16	2	
EUROPE																	
Belgium	3.56	74	212	291	195	106	52	38	18	4	5	3	1	3			
Csechoslovakia	3.34	39	165	451	212	85	30	13	2	4							
Denmark	3.55	61	116	370	242	147	32	19	8	4							
Finland	3.67	48	145	336	244	118	60	22	13	5	5	3	1				
France	3.69	60	158	308	228	122	54	36	23	3	3	5					
Great Britain	3.60	60	139	354	217	136	49	28	13	4							
Italy	3.38	58	170	387	228	94	36	10	7	4	5						
Netherlands*	2.67	171	289	303	184	39	13										
Norway	3.78	48	100	299	281	175	77	20									
Poland	3.78	31	140	357	223	125	58	33	14	7	8	1	1	1	1		
Portugal	2.95	58	182	312	161	102	56	44	31	19	9	8	7	3	2		
Spain	4.10	40	80	295	254	166	76	42	22	10	6	3	3	1			
Yugoslavia	4.05	43	121	351	183	110	56	52	40	21	22						

*In this context the Dutch data are not strictly comparable to the other countries because they are restricted to the marriage cohorts 1963–1973.

clearly that the ranking according to mean family size is not identical to those according to the mode or to the proportion with 15 or more children or any other single parity category. To shed more light on the relationship between the shape of the distribution and the average level we have to consider further aspects.

Of the functions introduced in the fertility table above, the parity progression ratios, $p(i)$, seem to show the most irregularity and sensitivity between populations and within populations. They represent the behavioral component in the fertility table. Because of this behavioral determination of the transitions to higher parity categories, the pattern of parity progression ratios is hard to describe by any standard function. The $f(i)$ and $l(i)$ functions must by definition decrease monotonically, the integral under the $d(i)$ function must equal $l(0)$; but for the parity progression ratios there is no restriction other than that the values must lie between zero and one. Unlike its counterpart in mortality analysis—the force of mortality function—the $p(i)$-function is very hard to describe by a parameterized model because its shape is biologically determined only in the case of completely natural fertility.

Keeping the great potential for irregularities in the parity progression ratios in mind, it is surprising to see how regular they turn out to be in less developed countries: the cohorts of ever-married women with completed parity show almost monotonically declining parity progression ratios from a maximum at parity zero to a minimum at the highest parity. There are a few exceptions. In some countries (e.g. in Cameroon) the parity progression ratios at parity zero are smaller than those at parity one, and in a relatively large number of countries the ratios level off or even increase at high parities. This may be partly due to irregularities because of small numbers in those categories, but a comparison to industrialized countries where this phenomenon is much stronger suggests that it may be a real effect due to heterogeneity in the population: there is one small group of women with extremely high fertility which, beyond a certain parity, dominates the picture.

Figure 1 shows a sample of different shapes of the parity progression functions in five countries with different fertility levels. Jordan has the highest cohort fertility among all WFS countries. There, parity progression ratios stay above .96 until parity six. We can see some increase from parity zero to one in Kenya and Cameroon. In other words, in Kenya and Cameroon the probability of a birth is higher for women who already had one birth than for women who are still childless, thus proving their fecundity. This observation can be made mainly in Eastern and Central Africa and is probably due to the high incidence of infecundity resulting from venereal disease and malnutrition. Between parities five and ten the parity progression ratios in Kenya and Cameroon decrease at an accelerating speed. After parity ten the pattern is more irregular but generally declining.

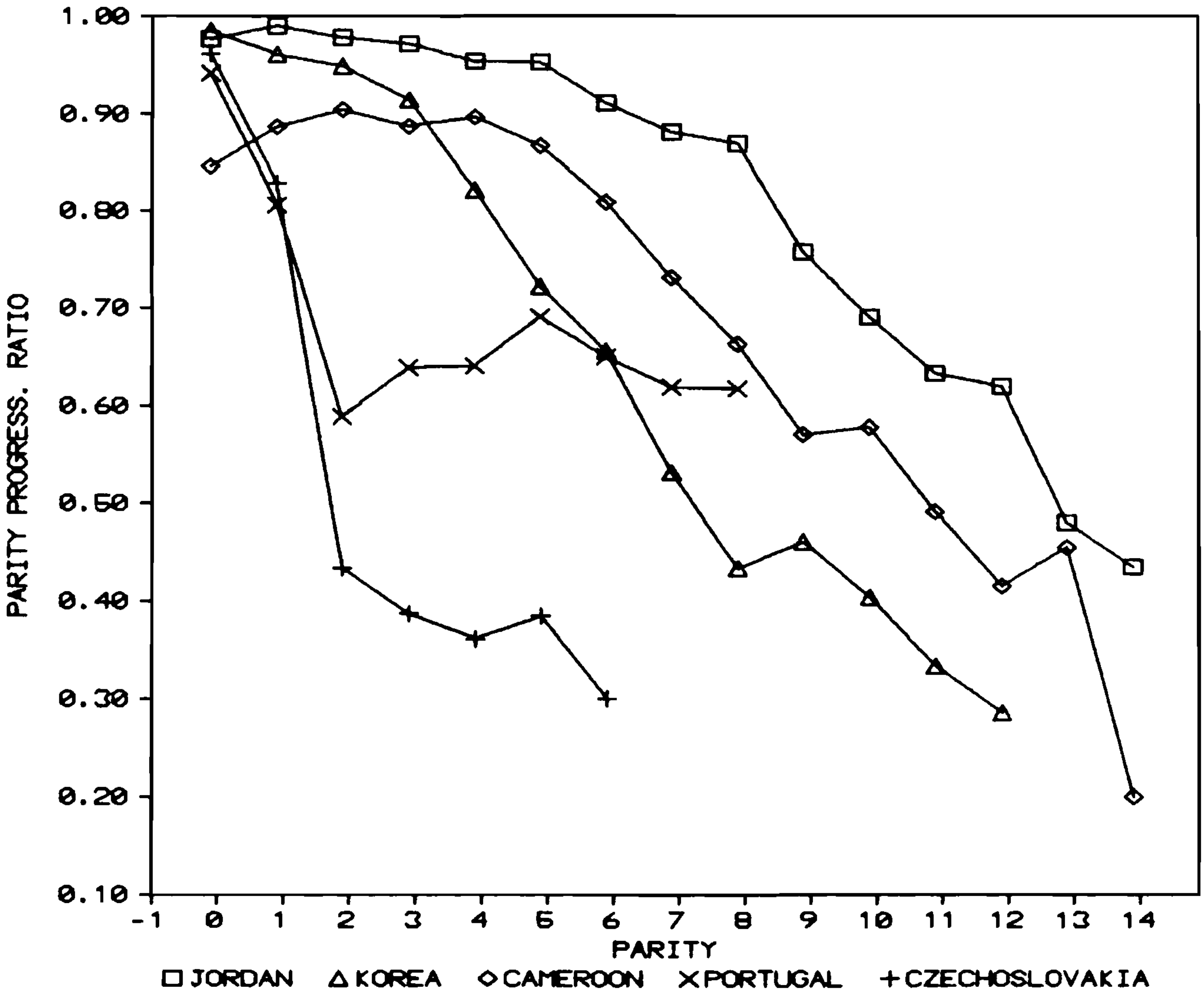

Figure 1. Parity progression ratios in Jordan, Korea, Cameroon, Portugal, and Czechoslovakia.

The pattern for Korea is quite different: a slow and almost linear decline between parities zero and four followed by a steeper but also linear decline for parities four to eight and nine to thirteen, excepting a slight increase between parities eight and nine. Typical patterns of parity progression ratios in low fertility industrialized countries are shown by Portugal and Czechoslovakia. This pattern is characterized by a steep decline in parity progression ratios until parity two after which the curve levels off or even increases. An increase in parity progression ratios at higher parities can be observed in many low-fertility countries and is due to selectivity of a few high-fertility women.

What is the reason for this dramatic shift in the pattern of parity progression ratios from high-fertility countries to low-fertility countries? Theoretically, a decline in fertility can happen in many different ways ranging from a proportional decline at each parity of the typical LDC curve to a stepwise function with high progression ratios up to a certain threshold parity and low ratios thereafter. The observed pattern of change becomes plausible when we think in terms of the paradigm of natural versus controlled fertility. In a natural fertility population (which we may assume for Kenya) women do not deliberately control their fertility in dependence on the number of children already born. Under such a fertility regime the pattern of parity progression ratios depends only on the change in fecundability and an increased prevalence of sterility with age and parity. These biological factors result in a monotonous decline which tends to be steeper after a certain threshold. In a controlled fertility situation, however, couples tends to follow their fertility intentions and parity progression ratios will be relatively high up to the mode of the desired family size distribution and lower thereafter.

A *prima facie* study suggested that in a great number of countries a level of .80 in the decline of the parity progression ratios might be considered a threshold, because the pace of decline increases after this level is achieved. This level can be used to rank countries according to the parity at which their parity progression ratios fall below .80. Table 3 ranks total and urban female populations aged 40–49. We can see that the total female population is distributed into two groups: the low-fertility countries are heavily concentrated at parity two whereas the high-fertility countries range between five and nine with a heavy concentration at parities seven and eight. For urban women the distribution is more even over all parities. This is mostly due to the high socio-economic differentials in Latin American countries, where the ratio for urban women falls below .80 already at parities three, four, and five.

A comparison between the above list and the distribution of average completed family sizes, $F(0)$, reveals that a later decline in parity progression ratios does not necessarily mean a higher mean number of children. This is because average completed parity also depends on the shape of the curve of parity progression ratios before and after our chosen value of .8. In Costa Rica, for instance, the parity progression ratio remains higher than .8 until parity nine, but many other countries with a lower threshold have higher fertility levels. Generally, however, for less developed countries the empirical correspondence between the ranking in Table 3 and average completed fertility is quite good because the shapes of the progression ratio curves are similar. For the more developed countries the ranking according to the critical point of .8 is less informative. The reason for this is the fast decline at low parities to levels below .8 and the high variance at higher parities.

Table 3. List of countries according to the parity at which the cohorts of ever-married women with completed parity reach parity progression ratios below .8.

A: Total	
1:	Belgium, Netherlands
2:	Czechoslovakia, Denmark, Finland, France, Great Britain, Italy, Norway, Poland, Portugal, Spain, United States, Yugoslavia
5:	Korea, Panama
6:	Ghana, Haiti, Indonesia, Lesotho, Nepal, Nigeria, Sri Lanka, Trinidad and Tobago
7:	Bangladesh, Benin, Cameroon, Egypt, Fiji, Jamaica, Malaysia, Mauritania, Pakistan, Peru, Sudan, Thailand, Tunisia, Turkey, Venezuela, Yemen
8:	Columbia, Dominican Republic, Ecuador, Guyana, Ivory Coast, Kenya, Mexico, Morocco, Paraguay, Philippines, Senegal, Syria
9:	Costa Rica, Jordan
B: Urban Women	
1:	Belgium, Czechoslovakia, Netherlands, Portugal
2:	Denmark, Finland, France, Italy, Norway, Poland, Spain, Yugoslavia
3:	Paraguay
4:	Dominican Republic, Haiti, Jamaica, Korea, Thailand, Turkey
5:	Fiji, Panama
6:	Benin, Cameroon, Costa Rica, Egypt, Ghana, Malaysia, Sri Lanka
7:	Ecuador, Guyana, Indonesia, Ivory Coast, Mauritania, Mexico, Morocco, Pakistan, Peru, Philippines, Senegal, Sudan, Trinidad & Tobago, Tunisia
8:	Columbia, Syria

The $l(x)$ column in the fertility table gives the number of women out of a cohort of 1000 that are still in the process of parity progression at parity x. The curve of $l(x)$ declines by definition from 1000 to 0 for every country. Differentials in the fertility level can be seen from the extent to which the curve is convex or concave.

Figure 2 plots the $l(x)$ function for five countries with different levels of fertility. The curve for Jordan lies to the far right of the other curves and is clearly concave. It somehow resembles the familiar pattern of a concave curve of age-specific marital fertility rates in natural fertility countries. This is not surprising because age and parity are

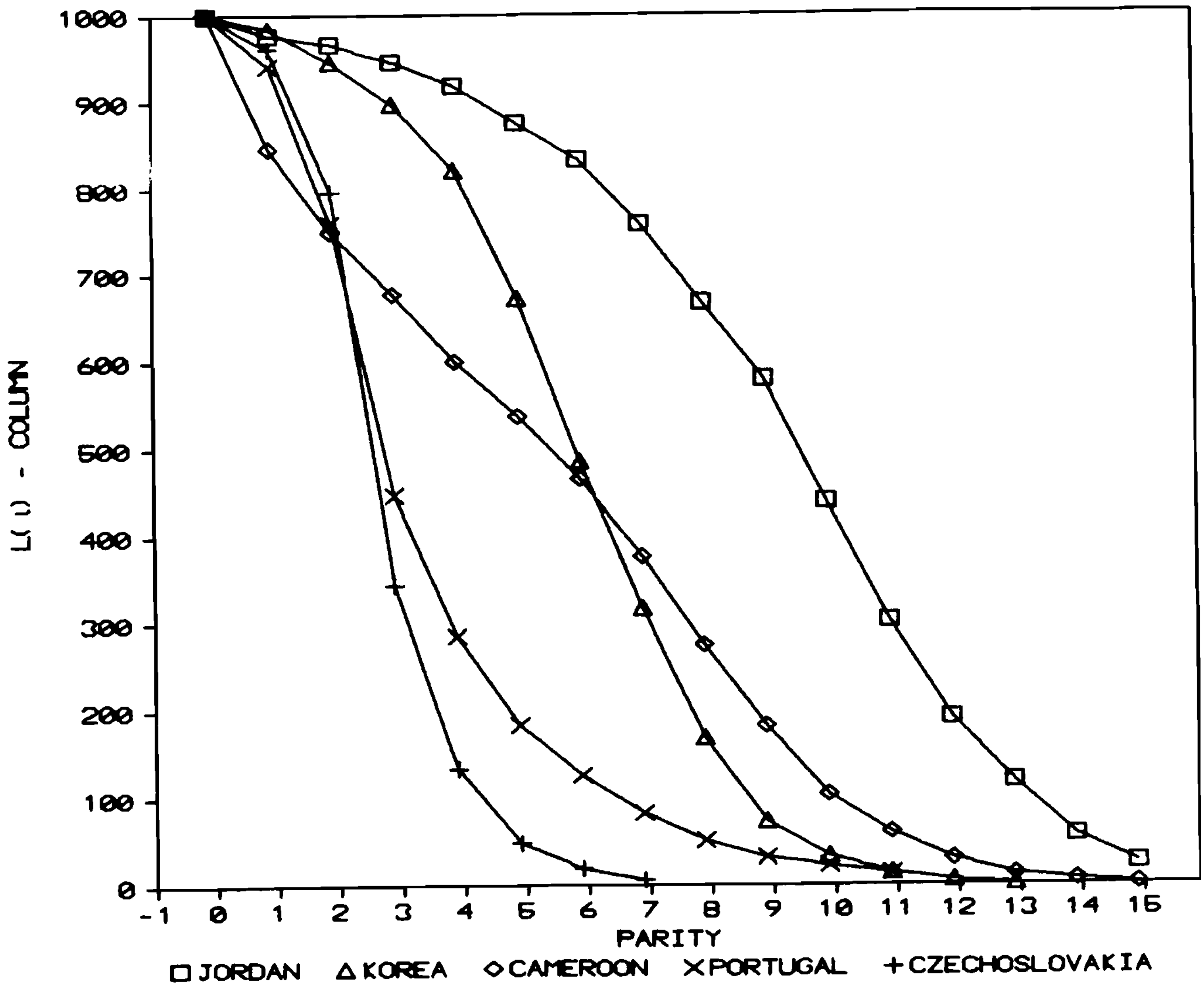

Figure 2. $l(i)$ column in Portugal, Jordan, Cameroon, Korea, and Czechoslovakia.

strongly correlated in a population without family limitation. To the far left lie the convex curves for Portugal and Czechoslovakia showing typical patterns of modern low fertility countries. The other curves lie between those two extremes. Cameroon exhibits an almost straight decline with parity whereas Korea follows the more general S-curve pattern that is typical for the majority of LDCs.

Tables 4 and 5 give global overviews on inter- and intra-country differentials in the $l(x)$ function.[13] Table 4 shows what proportion of the initial 1000 women had a third

[13]Educational and residential differentials were only given if a subgroup included more than 120 women and if it comprised less than 80% of the total. The dichotomies rural/urban and low/high education correspond

birth during their life. On the national level the values range from 95% in Jordan to about 35% in Czechoslovakia.[14] The range is even wider for residential or educational subpopulations.

Among urban European women it was only in Norway and Spain that more than 50% of the cohort had a third child. In rural areas, however, two thirds of the European countries show proportions of over 50%. Similar differentials appear with respect to education although in Belgium and the Netherlands a higher proportion of better educated women had third children than of less educated women. The relative extent of educational and residential differentials in Europe is quite irregular. Usually the residential differentials were greater. In four countries, most prominently in Yugoslavia, educational differentials were stronger.

Among the less developed countries socio-economic differentials are highest in Latin America. In several African countries as well as in Bangladesh and Indonesia (both Islamic), educated women had higher probabilities of having a third child. With respect to place of residence all countries (except for the Sudan) show higher proportions of rural women with third children than urban women. Among the 40 less developed countries studied here there are only five countries—namely Cameroon, Lesotho, Jamaica, Trinidad and Tobago, and Indonesia—where less than 80% of the women had third children. In Cameroon the percentage is only 67% which comes rather close to the highest European values. The reason lies in the relatively high proportion of childless and low-parity women in Cameroon.

Table 5 gives comparable figures for the proportions of women that had a seventh child. Since those proportions are extremely low in low-fertility countries, those countries were not included in the table. Within the LDCs, national levels range from a high of 76% in Jordan to lows of 32% in Korea, and 36–37% in Lesotho, Indonesia, Cameroon, and Nigeria.

Differentials in the proportions of women with a seventh birth with respect to place of residence and women's education are very substantial in most countries and greater than the differentials with respect to third births. In all cases except for Kenya, Lesotho, Mauritania, and Indonesia, differentials go into the expected directions with higher fertility in rural areas and for women without schooling. In the four countries that make the exceptions the differentials are lower. Without going into a more detailed country-specific

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to the definitions generally used by WFS. In LDCs the category of low education generally refers to women without any formal education, the other category to women with at least some education.

[14]The Netherlands have only 24% with a third child but, as stated before, the sample is not strictly representative.

Table 4. Number of women (out of 1,000) that had reached at least parity three, $L(3)$, according to place of residence and level of education.

	Total	Rural	Urban	Differ-ence	Rel. Diff. %	Education low	Education high	Differ-ence	Rel. Diff. %
AFRICA									
Benin	880	889	848	41	95%				
Cameroon	676	693	588	105	84%				
Egypt	884	891	875	16	98%	899	860	39	95%
Ghana	906	922	859	63	93%	910	879	31	96%
Ivory Coast	866	869	853	16	98%				
Kenya	922					909	958	-49	105%
Lesotho	782					758	794	-36	104%
Mauritania	834	853	803	50	94%	830	837	-7	100%
Morocco	854	881	806	75	91%				
Nigeria	801								
Senegal	882	895	847	48	94%				
Sudan	807	792	845	-54	106%				
Tunisia	913	923	903	19	97%				
AMERICAS									
Colombia	878	901	863	38	95%	900	833	68	92%
Costa Rica	865	928	802	127	86%	918	814	105	88%
Dominican Rep.	832	906	768	138	84%	847	804	43	94%
Ecuador	897	941	845	96	89%	951	836	115	87%
Guyana	835	877	755	122	86%	904	820	84	90%
Haiti	843	877	746	131	85%				
Jamaica	748	784	682	101	87%				
Mexico	870	925	831	95	89%	903	852	51	94%
Panama	834	908	782	125	86%	899	797	102	88%
Paraguay	826	859	782	77	91%	870	773	97	88%
Peru	891	919	873	46	94%	931	858	73	92%
Trinidad & Tobago	796	811	786	25	96%	886	776	110	87%
USA	644					667	634	33	95%
Venezuela	834					885	784	102	88%
ASIA AND PACIFIC									
Bangladesh	907					904	913	-9	101%
Fiji	854	868	826	42	95%	879	837	42	95%
Indonesia	765	767	755	12	98%	754	814	-59	107%
Jordan	947					952	930	21	97%
Korea	898	930	869	61	93%	913	885	28	96%
Malaysia	852	858	836	22	97%	869	822	47	94%
Nepal	847								
Pakistan	900	909	871	38	95%				
Philippines	901	911	877	34	96%	927	889	38	95%
Sri Lanka	835	845	780	65	92%	863	821	42	95%
Syria	927	934	921	12	98%	932	894	38	95%
Thailand	878	888	813	75	91%	879	874	5	99%
Turkey	879	941	802	139	85%	937	779	159	83%
Yemen	916								
EUROPE									
Belgium	423	434	421	13	97%	416	425	-9	102%
Czechoslovakia	348	471	297	174	63%	487	292	195	59%
Denmark	453	656	391	265	59%	497	366	131	73%
Finland	471	573	387	186	67%	537	389	148	72%
France	474	564	435	129	77%	500	428	72	85%
Great Britain	448					462	444	18	96%
Italy	385	403	362	41	89%	418	287	131	68%
Netherlands	237	429	164	265	38%	231	240	-9	103%
Norway	556	594	505	89	85%	656	519	137	79%

Poland	472	678	338	340	49%	594	276	318	46%
Portugal	447	519	295	224	57%	549	315	234	57%
Spain	485	626	578	48	92%	583	614	-31	105%
Yugoslavia	484	579	399	180	68%	515	148	367	28%

analysis one might assume that in those countries the reproductive behavior of educated and urban women was still traditional and higher socio-economic status resulted in higher fecundability, probably combined with less breastfeeding. Another, separate reason for the unexpected fertility differentials might also be due to differential quality of reporting, with educated women giving more complete birth histories than others. After all, these figures refer to women with their prime childbearing ages about 20 years before the survey. If a similar bias were also assumed for all other countries, this would mean even higher socio-economic differentials, than those observed in the survey.

Comparing continents we observe that, generally, socio-economic differentials in respect to the frequency of a seventh child are highest in Latin America. Absolute and relative differences are highest in Paraguay, Costa Rica, the Dominican Republic, and Panama for both place of residence and mother's education. The rural figures tend to be twice the urban in many cases. The relative importance of the residential and educational differentials varies from Central America and the Caribbean where urban-rural differentials tend to be higher to South America where women's education seems to be more important. The Asian countries tend to take an intermediate position between South America and Africa. Exceptions are Turkey, Korea, and Thailand, which stand out with very high differentials. Concerning the relative importance of the differentials the pattern is very irregular in Asia. In Syria, for instance, the difference in respect to schooling is four times the residential difference, whereas in Thailand the urban-rural differential is many times higher than the educational one. In Africa differentials tend to be moderate.

3. MEAN FAMILY SIZES AND CONCENTRATION OF THE DISTRIBUTION

It has been mentioned above that for many purposes the mean number of children even without information on the full distribution provides sufficient information. But when talking about the impact of mean family sizes we must be aware of the fact that there are two different means that both have significance: the mean from the mothers' perspective (mean parity) and the mean from the children's perspective (mean sibship size). While the first is the usual arithmetic mean of the distribution the second is called

Table 5. Number of women (out of 1,000) that had reached at least parity seven, $L(7)$, according to place of residence and level of education.

	Total	Rural	Urban	Differ-ence	Rel. Diff. %	Education low	Education high	Differ-ence	Rel. Diff. %
AFRICA									
Benin	494	506	453	53	89%				
Cameroon	375	401	238	163	59%				
Egypt	539	604	459	145	75%	568	492	76	86%
Ghana	510	524	469	55	89%	523	443	80	84%
Ivory Coast	586	593	556	36	93%				
Kenya	715					704	748	-44	106%
Lesotho	358					328	374	-47	114%
Mauritania	457	453	462	-9	102%	422	484	-61	114%
Morocco	613	649	527	122	81%				
Nigeria	378								
Senegal	610	625	575	50	91%				
Sudan	497	500	487	13	97%				
Tunisia	559	586	529	57	90%				
AMERICAS									
Colombia	531	599	489	110	81%	585	419	166	71%
Costa Rica	508	682	335	347	49%	660	361	299	54%
Dominican Rep.	460	626	316	311	50%	538	306	233	56%
Ecuador	535	633	411	222	64%	658	388	270	58%
Guyana	510	577	377	200	65%	601	489	111	81%
Haiti	428	471	289	182	61%				
Jamaica	410	497	252	245	50%				
Mexico	558	684	467	217	68%	650	507	143	77%
Panama	383	556	261	295	46%	570	281	289	49%
Paraguay	460	619	258	360	41%	615	274	341	44%
Peru	524	651	437	214	67%	680	393	287	57%
Trinidad & Tobago	364	434	319	115	73%	479	340	139	71%
Venezuela	451					596	312	284	52%
ASIA AND PACIFIC									
Bangladesh	602					593	652	-58	109%
Fiji	502	560	391	169	69%	549	468	81	85%
Indonesia	366	361	389	-27	107%	358	398	-40	111%
Jordan	760					826	569	256	68%
Korea	318	450	193	257	42%	437	224	213	51%
Malaysia	460	496	379	117	76%	490	405	85	82%
Nepal	404								
Pakistan	607	610	590	21	96%				
Philippines	553	611	427	183	69%	694	497	196	71%
Sri Lanka	400	423	296	126	70%	495	356	139	71%
Syria	660	692	629	63	90%	700	439	261	62%
Thailand	489	527	284	243	53%	510	473	37	92%
Turkey	427	554	260	295	46%	556	202	354	36%
Yemen	530								

the contra-harmonic mean. Intuitively the difference becomes clear when we think of asking a population of children for their family size: there will be no child which can say that its mother had zero children, whereas childlessness is possible in the population of women. Also a family with, for example, eight children will have eight times as many children in the children's population that will say that they have a sibship size of eight than a family with just one child who will state it has sibship size one—although for the calculation of mean parities both families get equal weight. From this we can already see that the mean sibship size is always greater than the mean parity. Only in the hypothetical case that all women had exactly the same number of children, would the two means be identical.

Formally the relationship between the two means can be described in the following manner:[15] let $f(x)$ be the proportion of women with completed parity x. Then the mean parity is

$$\bar{x} = \sum_{1}^{m} f(x)x \tag{1}$$

where m is the maximum parity considered. The mean sibship size is then

$$\bar{c} = \sum_{1}^{m} \frac{f(x)x}{\sum_{1}^{m} f(x)x} x = \frac{\sum_{1}^{m} f(x)x^2}{\bar{x}} \tag{2}$$

where the weight in the summation represents the proportion of children from families of size x.

It can be shown[16] that the difference between women's mean family size ($\bar{x}$) and children's mean family size ($\bar{c}$) is a function of the second moment of the distribution:

$$\bar{c} = \frac{\sigma_x^2}{\bar{x}} + \bar{x} \tag{3}$$

where σ_x^2 is the variance of the distribution of family sizes among women.[17]

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[15]Following S. Preston, 'Family sizes of children and family sizes of women', *Demography* **13**, 1 (1976), pp. 105–114.

[16]Preston, *op. cit.*, in footnote 15.

[17]J. Vaupel and D. Goodwin, *Concentration Curves and Have-Statistics for Ecological Analysis of Diversity: Part III: Comparison of Measures of Diversity*, WP–85–91 (Laxenburg, Austria: International Institute for Applied Systems Analysis, 1985), modified Preston's algebra a bit by giving the mean ratio:

$$\rho = \frac{\bar{x}}{\bar{c}} = \frac{1}{I+1}$$

where I is the square of the coefficient of variation of the distribution of women by number of children. That is,

$$I = \frac{\sigma_x^2}{\bar{x}^2} \quad .$$

I was introduced by J.F. Crow, 'Some possibilities for measuring selection intensities in man', *Human Biology*, **30** (1958), pp. 1–13, for a summary measure of unevenness of a distribution.

This difference between the mean family sizes for women and children has several demographic and non-demographic consequences that will be considered in the discussion session below. Here, the difference between the two means is taken as one possible indicator of the unevenness in the completed parity distribution.

Table 6 gives the mean parities and mean sibship sizes for all WFS countries. We see that a ranking according to mean sibship size turns out to be quite different from that according to mean parity, although Jordan has the highest values for both means. Kenya, which has the second highest mean parity is under the children's perspective surpassed by Costa Rica and Syria that both show mean sibship sizes of more than nine children. The reason for these changes in the rank order lie in differential shapes of the parity distributions resulting in different relative variations of the distribution.

Columns (3) and (4) of Table 6 give the absolute and relative differences between the two means. Seven countries, namely Cameroon, Columbia, Costa Rica, Dominican Republic, Guyana, Jamaica, and Trinidad and Tobago have a difference of more than two children between mean parity and mean sibship. Six of these countries are in Latin America indicating that the unevenness in the parity distribution tends to be greatest there. In Europe the absolute differences are on the order of between .62 (Czechoslovakia) and 1.69 children (Portugal).

Relative differences (column 4),[18] however, are a better measure of unevenness because they abstract from the level of fertility and are therefore better suited for a comparison between high- and low-fertility countries. The relative difference between mean parity and mean sibship size turns out to be greatest in two countries as different as Portugal (63%) and Cameroon (65%). A view to the parity progression ratios in Figure 1 tells us that in Portugal this is due to unusually high progression ratios at higher parities as compared to the typical pattern of a low-fertility country; in Cameroon we find the opposite form of deviation from the typical high-fertility pattern, namely unusually low progression ratios at low parities. Both deviations from the average high- and low-fertility patterns result in increased relative variance or, in other words, a stronger heterogeneity of the countries' female populations. Next to these two extreme cases come several Latin American and European countries where the mean parities tend to be between 65% and 75% of the mean sibship sizes. The lowest relative difference is found in some Asian and African countries (Jordan 87%, Kenya 86%, Korea 85%, Ghana 84%).

[18] They are identical with the mean ratios introduced in the previous footnote.

Table 6. Mean family sizes and concentration indices for all WFS countries.

	(1) Mean parity	(2) Mean sibship size	(3) (2)-(1)	(4) (2)/(1)	(5) .5 fractile	(6) Index of dissimilarity	(7) Gini-coefficient
AFRICA							
Benin	6.10	7.41	1.31	0.82	0.335	0.187	0.257
Cameroon	4.86	7.53	2.67	0.65	0.256	0.317	0.414
Egypt	6.59	8.12	1.53	0.81	0.330	0.190	0.264
Ghana	6.33	7.54	1.21	0.84	0.342	0.175	0.240
Ivory Coast	6.72	8.32	1.60	0.81	0.332	0.196	0.266
Kenya	7.69	8.96	1.27	0.86	0.362	0.155	0.218
Lesotho	5.19	6.91	1.73	0.75	0.297	0.239	0.323
Mauritania	5.96	7.78	1.82	0.77	0.303	0.224	0.308
Morocco	7.03	8.92	1.89	0.79	0.324	0.206	0.285
Nigeria	5.46	7.34	1.89	0.74	0.291	0.244	0.335
Senegal	6.90	8.37	1.47	0.82	0.339	0.187	0.257
Sudan	5.95	7.83	1.88	0.76	0.309	0.232	0.313
Tunisia	6.72	8.06	1.35	0.83	0.342	0.175	0.242
AMERICAS							
Colombia	6.84	8.86	2.02	0.77	0.303	0.222	0.301
Costa Rica	6.86	9.14	2.27	0.75	0.290	0.239	0.321
Dominican Rep.	6.35	8.54	2.19	0.74	0.289	0.247	0.330
Ecuador	6.94	8.71	1.77	0.80	0.314	0.206	0.283
Guyana	6.42	8.48	2.06	0.76	0.301	0.232	0.317
Haiti	5.76	7.32	1.57	0.79	0.312	0.215	0.291
Jamaica	4.65	7.27	2.61	0.64	0.249	0.284	0.356
Mexico	6.98	8.94	1.97	0.78	0.311	0.215	0.296
Panama	5.69	7.48	1.78	0.76	0.295	0.227	0.310
Paraguay	4.85	6.82	1.97	0.71	0.265	0.259	0.348
Peru	6.70	8.44	1.73	0.79	0.314	0.206	0.282
Trinidad & Tobago	5.45	7.51	2.06	0.73	0.281	0.250	0.341
USA	3.47	4.77	1.31	0.73	0.283	0.236	0.329
Venezuela	6.17	8.04	1.87	0.77	0.297	0.229	0.308
ASIA AND PACIFIC							
Bangladesh	6.89	8.24	1.35	0.84	0.344	0.170	0.240
Fiji	6.26	8.01	1.75	0.78	0.316	0.211	0.291
Indonesia	5.21	7.15	1.94	0.73	0.287	0.253	0.342
Jordan	8.61	9.95	1.34	0.87	0.362	0.154	0.214
Korea	5.39	6.34	0.95	0.85	0.348	0.164	0.229
Malaysia	6.09	7.83	1.74	0.78	0.308	0.217	0.298
Nepal	5.61	7.02	1.41	0.80	0.321	0.204	0.279
Pakistan	6.85	8.27	1.42	0.83	0.342	0.176	0.247
Philippines	6.80	8.34	1.54	0.82	0.328	0.191	0.262
Sri Lanka	5.68	7.33	1.65	0.78	0.308	0.216	0.297
Syria	7.59	9.05	1.46	0.84	0.345	0.170	0.237
Thailand	6.30	7.88	1.58	0.80	0.320	0.200	0.275
Turkey	6.03	7.70	1.67	0.78	0.306	0.210	0.288
Yemen	6.61	7.97	1.36	0.83	0.335	0.183	0.251
EUROPE							
Belgium	2.57	3.85	1.28	0.67	0.261	0.267	0.368
Czechoslovakia	2.32	2.94	0.62	0.79	0.316	0.194	0.267
Denmark	2.53	3.26	0.73	0.78	0.315	0.209	0.285
Finland	2.67	3.61	0.94	0.74	0.298	0.223	0.309

France	2.69	3.75	1.06	0.72	0.283	0.239	0.331
Great Britain	2.58	3.42	0.84	0.75	0.300	0.224	0.306
Italy	2.37	3.18	0.81	0.75	0.304	0.217	0.300
Netherlands	1.67	2.46	0.79	0.68	0.267	0.287	0.379
Norway	2.75	3.38	0.63	0.81	0.328	0.193	0.264
Poland	2.78	3.78	1.00	0.74	0.293	0.221	0.306
Portugal	2.91	4.60	1.69	0.63	0.239	0.278	0.384
Spain	3.09	4.08	0.99	0.76	0.301	0.207	0.295
Yugoslavia	3.05	4.36	1.31	0.70	0.263	0.249	0.343

Another way to look at the unevenness in the fertility distribution is to view it in terms of concentration. Concentration analysis generally studies the degree to which a certain proportion of producers dominates the market, i.e. makes a large proportion of the products.[19] In the case of fertility analysis women may be seen as potential producers whereas the children are considered to be the products. Hence, we study what proportion of women produces what proportion of children. The best way to describe this for the complete parity distribution is the Lorenz curve that on the x-axis has the cumulated proportions of women at each parity and on the y-axis the cumulated proportions of children borne by these women (see Figure 3). Women are ranked from most productive (highest parity category) to least productive (childless). The data used to construct the curve for four selected WFS countries is given in Table 7 which can be directly calculated from the information of Table 1.

[19] It is helpful to distinguish between absolute concentration that looks at the share produced by a certain absolute number of producers (e.g. the top ten) and relative concentration that refers to a certain proportion of all producers (e.g. the top 10%). In this context of the study of fertility concentration we are only interested in relative concentration.

Table 7. Data for Lorenz curve: Czechoslovakia, ever-married women aged 40–45.

	Proportion of women i	Proportion of children x_i	Cumulated proportion of women y_i	Cumulated proportion of children X_i
0	.039	0	1.000	1.000
1	.165	.071	.961	1.000
2	.451	.389	.797	.930
3	.212	.274	.346	.541
4	.085	.147	.134	.267
5	.030	.065	.048	.120
6	.013	.034	.019	.055
7+	.006	.021	.006	.021

Figure 4 gives such Lorenz curves for four selected WFS countries. The diagonal stands for the case of a completely even distribution with all women having the same number of children. The further the Lorenz curve lies away from the diagonal, the greater is the concentration of the distribution. It is interesting to see that Jordan, the country with the highest level of fertility and Czechoslovakia with one of the lowest levels show an equally low degree of concentration. The Lorenz curves of Cameroon and Portugal lie clearly further away from the diagonal indicating a significantly higher degree of concentration in the distribution of completed family sizes. A cross-over of the curves indicators that the major sources of concentration lie at different ends of the parity distribution. In the case of Portugal and Cameroon this has been discussed above.

The Lorenz curves give a complete picture of the distribution and contains all the necessary information to describe differential concentration patterns in detail. For many analytical purposes, however, it is desirable to have a single indicator of concentration rather than the full Lorenz curve. Many such indices exist in the literature. The most popular ones for the study of relative concentration are the Gini Coefficient and the Index of Dissimilarity. Both can be directly derived from the Lorenz curve where the Gini Coefficient gives the area between the Lorenz curve and the diagonal as a fraction of the full triangle under the diagonal, whereas the index of dissimilarity gives the maximum vertical distance from the Lorenz curve to the diagonal.[20] Other possible indices that have

[20] If X_i and Y_i are respective cumulative percentages and n is the number of units, then the Gini-coefficient G is defined by

$$G = (\sum_{i=1}^{n} X_1 Y_{i+1}) - (\sum_{i=1}^{n} X_{i+1} Y_i) \quad .$$

The index of dissimilarity may be defined as the sum of the positive differences between the two percentage distribution x_i and y_i

$$DI = \frac{1}{2} \sum_{i=1}^{n} |x_i - y_i| \quad .$$

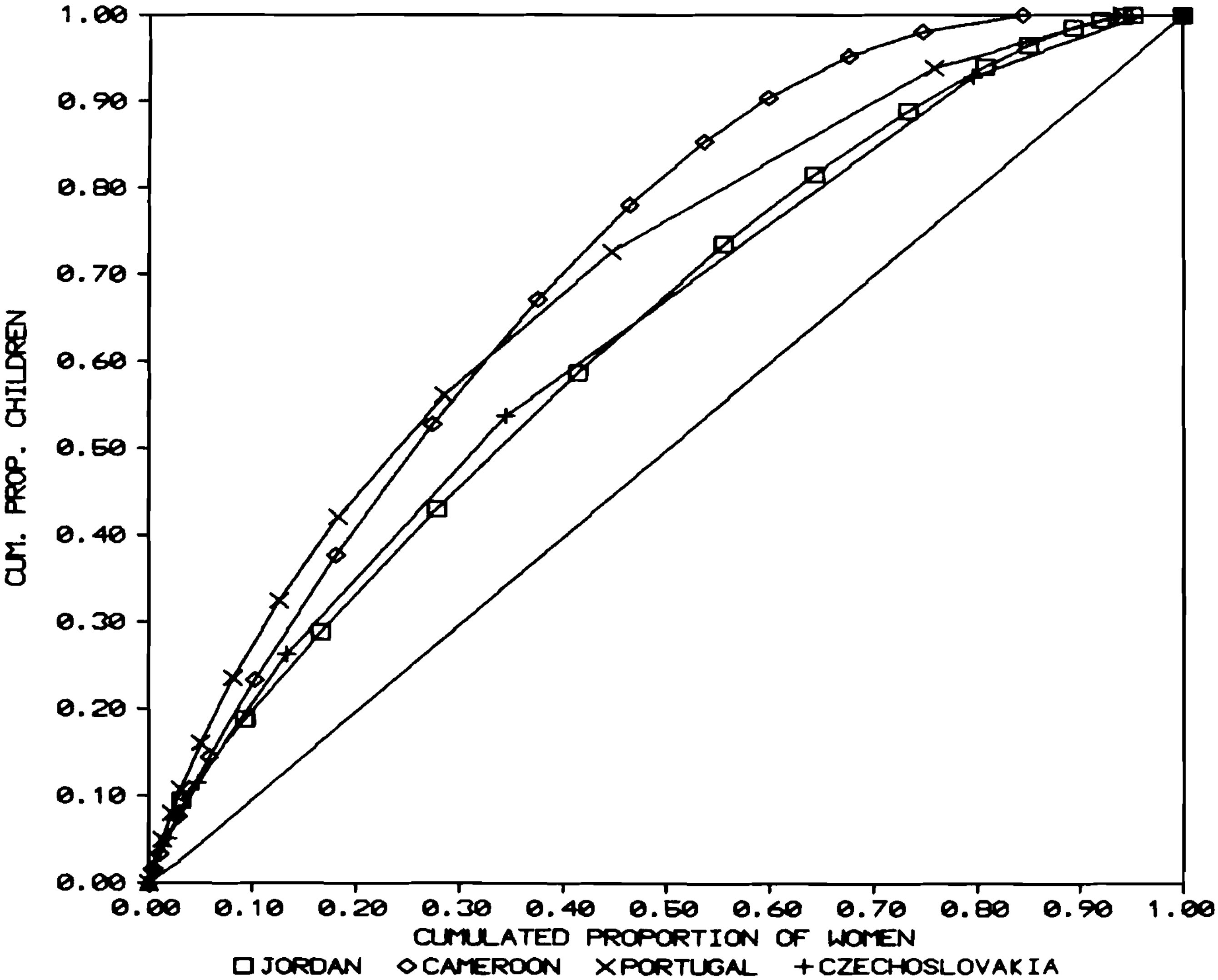

Figure 3. Lorenz curves for selected countries.

a more intuitive interpretation are the fractiles. They indicate what proportion of women has 10%, 25%, 50%, etc. of all children. A disadvantage of fractiles that are close to one end of the Lorenz curve lies in the fact that they are rather insensitive to changes at the other end of the curve. For this reason the 50% fractile is preferable to the others as a summary indicator of the whole curve. Graphically the .5 fractile is the X-value at which a horizontal line at the level of $Y = .5$ crosses the Lorenz curve (see Figure 3). It can be

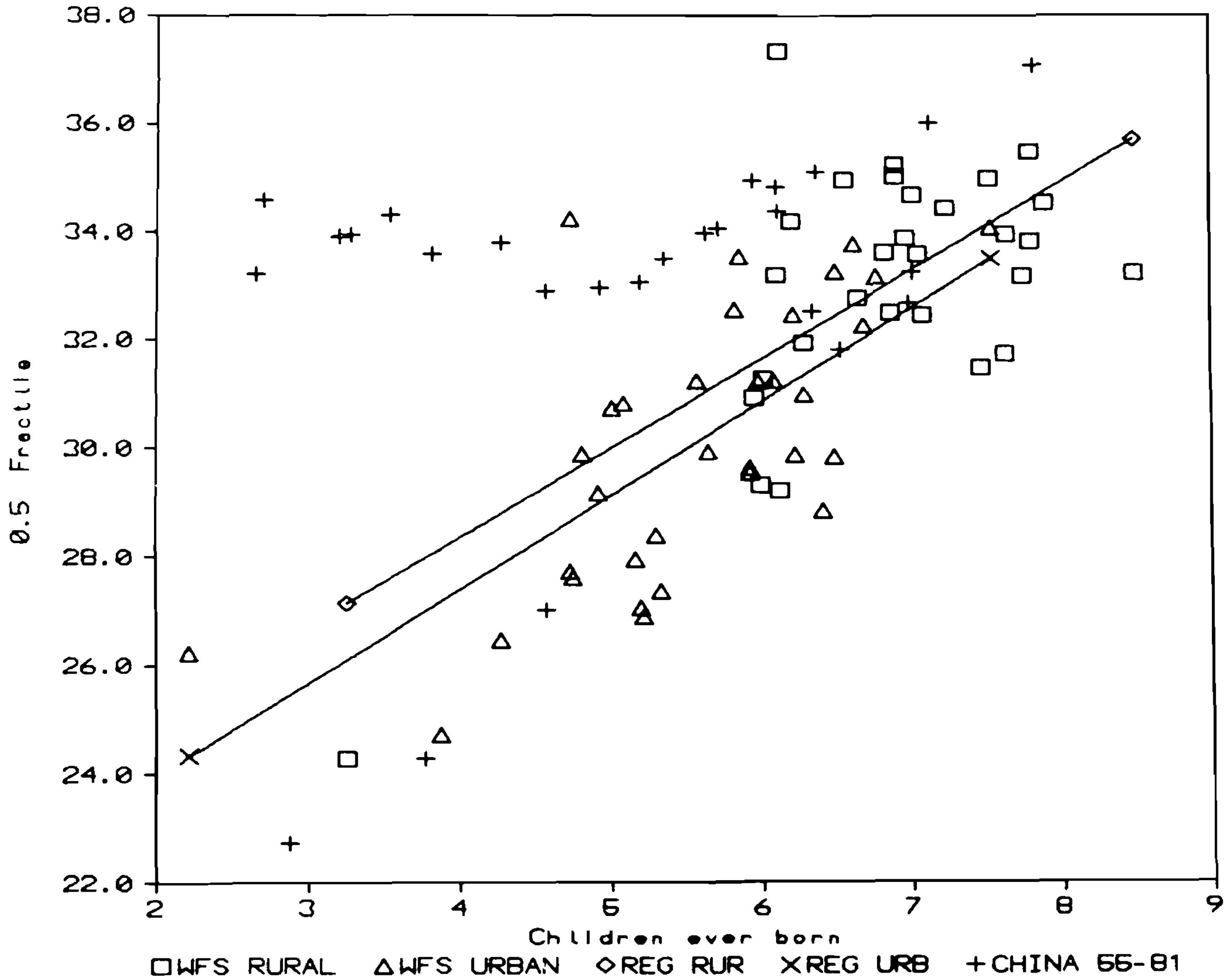

Figure 4. Relationship between mean completed family size and the concentration of fertility for a cross-section of LDCs and China, 1955–1981.

easily interpreted as the proportion of women that has half the children.[21]

To facilitate a comparison between the different indices of concentration, Table 6 lists the .5 fractile, the Index of Dissimilarity, and the Gini Coefficient. For the latter two a higher value of the index means higher concentration; for the .5 fractile a lower percentage of women that has half the children indicates higher concentration. Since all three indices attempt to summarize the information given by the Lorenz curve by different means

[21]For this reason Vaupel and Goodwin, *op. cit.*, in footnote 17 refer to the .5 fractile as the "Havehalf".

it is not surprising that they essentially show the same pattern. Calculating correlation coefficients between the various indicators over all WFS countries results in coefficients of above .96.[22] It is also not surprising that the correlation coefficient between any of the concentration indices and the measure of relative differences between mean parity and mean sibship (column 4 in Table 6) is much higher (above .96) than in relation to the absolute differences (around .45), because unlike the concentration indices and the relative difference the absolute difference depends on the level of fertility.

It is, however, surprising to see that the level of fertility (mean parity) shows a rather clear negative association to concentration: the lower the level of fertility, the higher the concentration. This results in a correlation coefficient of .59 between mean parity and the .5 fractile. If only the 41 LDC-WFS countries are considered, the correlation even increases to .981. A closer analysis of this pattern reveals that over the course of demographic transition a declining level of average fertility is associated with increasing relative variation in the distribution and hence increasing concentration. This strong association has also been shown for marital fertility declines in Germany and Austria between 1895 and 1939 by occupational groups[23] and for time series of US parity distributions.[24] In addition to this evidence most high fertility countries for which parity distributions are available by age groups beyond reproductive age confirm this strong negative association between the level of fertility and concentration over the course of demographic transition.[25]

For the European countries and the USA this general pattern no longer holds. At their stage of development lower average fertility does not necessarily increase concentration. In those countries concentration is generally lower at a given level of fertility than could be expected from the LDC association between the two variables. There seem to be two reasons for this: first, in Europe where sizable proportions of women remain unmarried the fact that the WFS samples include only married women makes the pattern more homogeneous; secondly, most of the cohorts studied in the European surveys had taken part in the post-war baby boom that, above all, had resulted in an amazingly homogene-

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[22] Especially the Gini Coefficient and the Index of Dissimilarity seem to be very closely related with a correlation coefficient of .993.

[23] W. Lutz and J. Vaupel, 'The division of labor for society's reproduction: on the concentration of childbearing and rearing in Austria', *Österreichische Zeitschrift für Statistik und Informatik*, **1–2** (1987), pp. 81–96.

[24] J. Vaupel and D. Goodwin, 'The concentration of reproduction among US women, 1917–80', *Population Development Review*, **13** (4) (1988), pp. 723–730; M. King and W. Lutz, *Beyond "The Average American Family": U.S. Cohort Parity Distributions and Fertility Concentration*, WP-88-13 (Laxenburg, Austria: International Institute for Applied Systems Analysis, 1988).

[25] W. Lutz, *The Concentration of Reproduction: A Global Perspective*, WP-87-51 (Laxenburg, Austria: International Institute for Applied Systems Analysis, 1987).

ous pattern of childbearing.[26] Recent trends observed from other statistical sources[27] seem to indicate that recent fertility declines in Europe are again associated with increasing concentration, mostly because of increasing proportions of childless women.

Figure 4 plots the association between the mean parity and the .5 fractile for rural and urban subsamples of LDC-WFS countries. Although these represent cross-sectional data one might interpret them in terms of a trend when we assume that the countries are with some variation at different stages of a universal development from high to low fertility. The pattern appearing for this WFS cross-section corresponds exactly to the time series evidence from other sources stated above. Even the regression lines for the subsets of urban and rural populations are almost exactly parallel. Generally, Asian countries tend to lie above the regression lines, i.e. reveal less concentration at a given level of fertility, whereas Latin American countries tend to lie under the line. Korea is the most extreme case of the Asian pattern (outlier above the regression line), but even there the line from the rural to the urban subpopulations runs parallel to the general trend.

An interpretation for this seemingly universal pattern of association between the level of fertility and its concentration over the course of demographic transition is that women tend to adopt the new patterns of reproductive behavior with different speed. In a natural fertility situation differential fecundability is the major source of variation in the completed parity distribution. When, however, parts of the population start to practise family limitation while others still stay with traditional patterns, an additional source of variation in the fertility distribution is introduced that results in higher concentration. This is not a statistical artefact; if reduction in fertility were proportional it would not affect concentration. It can be shown that this association between the level and the concentration of fertility is not a statistical artefact[28] but reflects real changes in the degree of heterogeneity in reproduction. There is also one very prominent exception from this general pattern which proves that strong fertility declines do not automatically lead to higher concentration.

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[26] See Lutz, *op. cit.*, in footnote 25; Vaupel and Goodwin, *op. cit.*, in footnote 24.

[27] Lutz and Vaupel, *op. cit.*, in footnote 23.

[28] If the reduction in fertility were proportional in all groups of women, this would not affect concentration.

CHINA: THE GREAT EXCEPTION

Feeney and Yu[29] recently presented time series of estimates for period parity progression ratios for China for the period 1955–1981, based on the National One-per-Thousand Fertility Survey. These parity progression ratios can be easily converted into completed parity distributions implied by observed period behavior and serve as input data to an analysis of distributional aspects of Chinese fertility trends.

Table 8. Mean family sizes and concentration of fertility in China, 1955–1981.

	Total			Rural			Urban		
Year	Mean/ Woman	Mean/ Child	Havehalf	Mean/ Woman	Mean/ Child	Havehalf	Mean/ Woman	Mean/ Child	Havehalf
1955	6.99	8.14	0.33	7.08	8.19	0.33	6.36	7.70	0.32
1956	6.53	7.92	0.32	6.56	7.94	0.32	6.36	7.74	0.32
1957	7.02	8.08	0.33	7.04	8.11	0.33	6.79	7.89	0.33
1958	6.35	7.65	0.33	6.39	7.71	0.32	6.09	7.29	0.34
1959	4.57	6.54	0.27	4.55	6.62	0.27	4.60	6.10	0.30
1960	3.77	5.94	0.24	3.62	5.94	0.23	4.31	5.80	0.29
1961	2.88	4.86	0.23	2.86	4.88	0.22	3.05	4.74	0.25
1962	6.12	7.19	0.34	6.30	7.34	0.35	5.16	6.24	0.33
1963	7.83	8.27	0.37	7.95	8.34	0.37	6.89	7.77	0.35
1964	7.13	7.88	0.36	7.38	8.02	0.36	5.28	6.32	0.33
1965	6.37	7.33	0.35	6.92	7.72	0.36	3.91	4.77	0.33
1966	6.11	7.07	0.35	6.80	7.57	0.36	3.29	4.05	0.33
1967	5.20	6.30	0.35	5.83	6.84	0.34	3.20	3.83	0.34
1968	5.95	6.86	0.35	6.45	7.24	0.36	4.00	4.77	0.34
1969	5.64	6.62	0.34	6.06	6.94	0.35	3.79	4.59	0.34
1970	5.72	6.71	0.34	6.15	7.04	0.36	3.61	4.33	0.34
1971	5.36	6.39	0.34	5.79	6.72	0.35	3.23	3.90	0.34
1972	4.93	5.97	0.33	5.33	6.29	0.34	3.09	3.73	0.33
1973	4.57	5.55	0.33	4.66	5.80	0.32	2.93	3.45	0.35
1974	4.28	5.10	0.34	4.65	5.43	0.35	2.61	3.03	0.36
1975	3.83	4.59	0.34	4.15	4.88	0.35	2.41	2.84	0.35
1976	3.55	4.23	0.34	3.85	4.49	0.35	2.23	2.63	0.34
1977	3.29	3.92	0.34	3.53	4.14	0.35	2.17	2.55	0.35
1978	3.21	3.79	0.34	3.43	3.99	0.35	2.12	2.42	0.38
1979	3.22	3.81	0.34	3.43	4.00	0.35	2.00	2.31	0.38
1980	2.72	3.23	0.35	2.93	3.41	0.35	1.62	1.89	0.37
1981	2.66	3.25	0.33	2.92	3.47	0.34	1.62	1.89	0.37

[29] G. Feeney and J. Yu, 'Period parity progression measures of fertility in China', *Population Studies*, **41** (1) (1987), pp. 77–102.

Table 8 gives the mean parity, mean sibship size and the .5 fractile as a measure of concentration for all years from 1955 to 1981. Since these measures are based on period data they are also subject to short-term period fluctuations as well as to longer term trends. The period meant parity given is comparable to the total fertility rate calculated from age-specific observations: both give the mean number of children of a synthetic cohort based on period observations. Here the mean family sizes calculated from completed parity distributions are not exact in considering births of orders eight and above.[30] Further the time series of total fertility rates and mean parities under a parity-specific approach cannot be expected to be identical because one approach considers the age distribution of the population while the other is based on the parity distribution. But since age and parity are highly correlated the empirical findings will not be very different.[31]

The series of period fertility levels in China show two strong declines since 1955: a precipitous decline from a mean parity of above seven in 1957 to as low as 2.88 in 1961, followed by a fast and full recovery in the following two years, and a somewhat slower but lasting decline since the early 1960s. While the first may be considered a short-term fertility fluctuation due to crisis and famine, the second represents the great and extraordinary fast Chinese fertility transition. This decline was especially impressive in the urban areas of China where the fertility level in 1981 was lower than that in many European countries. Aside from this well-known and often referred to trend in the level of Chinese fertility, Table 7 also reveals a much less known feature of this amazing fertility decline. In China the fertility transition was not associated with an increase in concentration; the fertility decline seems to have taken place in an extremely homogeneous manner.

Figure 5 illustrates the association between the level of fertility and its concentration in China between 1955 and 1981. Until 1958 the pattern was not different from that in the high-fertility WFS countries described above. The extreme short-term decline in period fertility during the years of famine and crisis (1958–1961) brought about a very significant increase in concentration followed by a return to the pre-transitional regime in both the level and concentration of fertility. During these years of crises and recovery the association between the level and concentration followed almost exactly the regression line shown in Figure 4 for the cross-section for WFS-LDCs. The recent fertility decline since 1963, however, was of a very different nature: after some initial increase in concentration, since 1970 the .5 fractile remains at an almost constant level of low concentra-

[30] Since the parity progression ratios given by Feeney and Yu, *op. cit.*, in footnote 27, ended at parity eight, one must make adjustments for higher-order births. In this paper it is assumed that women with eight or more births have, on the average, nine births.

[31] Lutz and Feichtinger, *op. cit.*, in footnote 1.

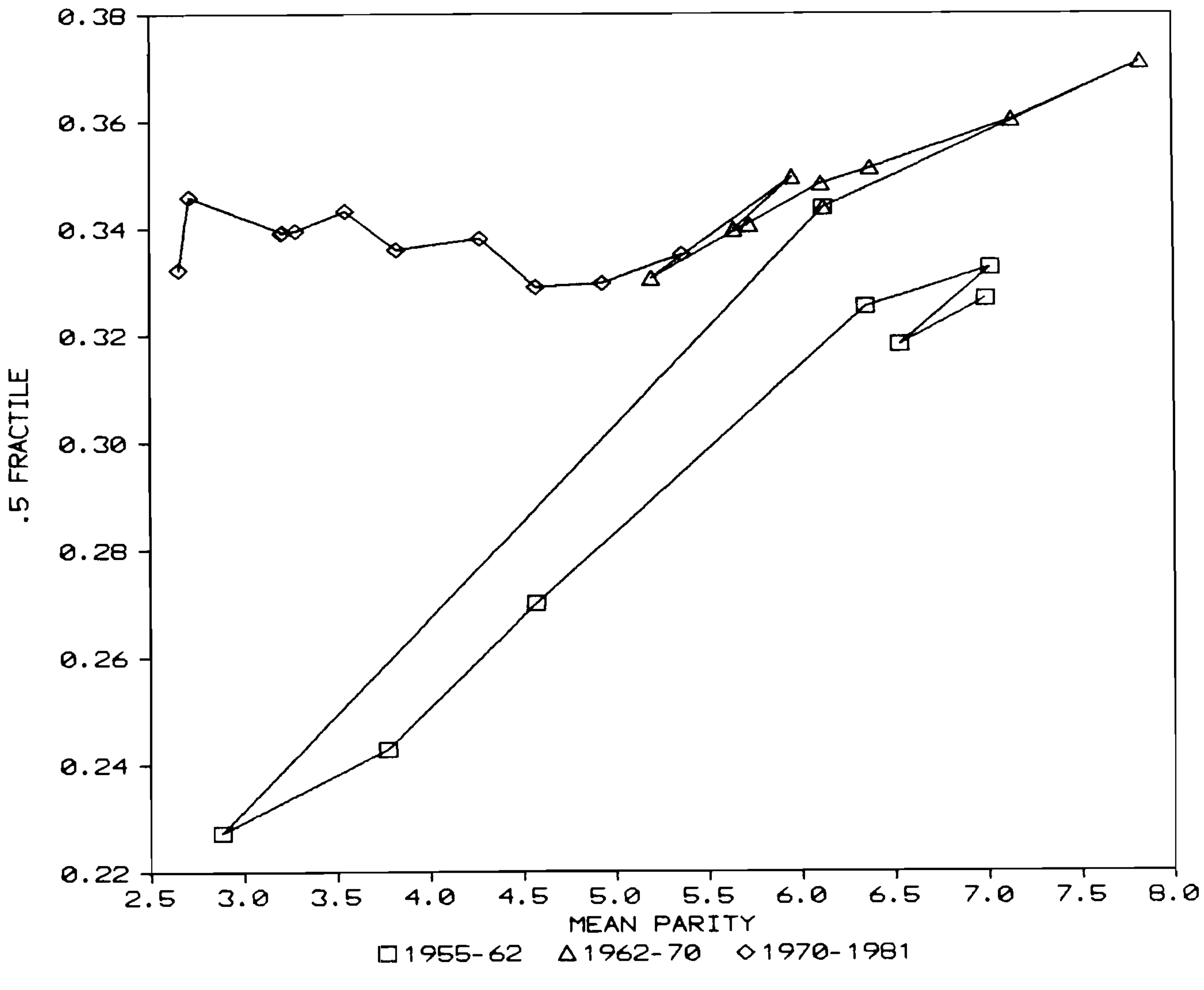

Figure 5. Cross-classification .5 fractile – mean China.

tion. This deviation from all other known cases of fertility transitions is even more extreme in the urban areas of China where at very low levels of fertility (means below two children), degrees of evenness were achieved that to our knowledge have not been experienced by any other sizable population.

A consequence of the stable level of concentration (or even decrease in urban areas) is that the mean sibship, i.e. the mean family size from the child's perspective, declined even more strongly than the mean from the women's perspective: from 8.27 in 1963 to 3.25 in 1981. Contrarily, during the extraordinary fertility decline of 1959–1961 the mean from the children's perspective declined less than from the women's perspective because of simultaneously increasing concentration. By 1981 the mean family size from the children's perspective had declined to the very low value of 1.89 in the cities of China. This is probably the lowest value of mean sibship size of any sizable population in the whole world including the very low fertility cities of West Germany or northern Italy. The reason for this is that even in a modern industrialized city where the total fertility rate might be lower than in Chinese cities, the mean family size from the children's perspective is greater because of higher concentration: this is mainly a consequence of high proportions of women expected to remain childless (generally more than 30%) in European cities. In sharp contrast to this the parity-specific fertility pattern of urban China in 1981 implies that only 2.1%[32] of all women remain childless.

4. DISCUSSION

The number of children in a family is not only of fundamental importance to the parents and to the children but also to society. The past and present fertility patterns have far-reaching consequences on areas ranging from the size of future generations to the mode of individual socialization in childhood and affect sociological, economic, political, psychological, and even cultural questions. Scientific literature on the consequences of fertility levels is abundant. There is no doubt about the fact that the level of fertility matters, although the nature of the effects is still quite controversial. In the following paragraphs a much less recognized aspect of the consequences of fertility patterns shall be discussed, namely the effects of the distributional aspects of fertility that are independent from the level of fertility. Hence we want to discuss whether at a given level of fertility higher or lower relative variance or concentration of the distribution makes any difference. A few selected aspects of this will be briefly mentioned below without any in-depth discussion.

First, in the strictly demographic field it can be shown that some degree of orientation[33] of daughter's family size on their mother's family size together with some concentration (non-zero variance) in the parity distribution will result in higher fertility levels in

[32]This low percentage is even under the assumption that all of the .7% of the women that remain unmarried according to the period rates also remain childless. Of all married women the expected proportion childless is only 1.4%.

[33]We do not use the notion of correlation here because the correlation coefficient could be also high if the daughter's fertility were generally by a constant (e.g. one child) lower than the mother's fertility. Hence orientation could be defined as an analogon to correlation but without the insensitivity to shifts up and down the scale. For a detailed discussion of this see W. Lutz and Th. Pullum, 'How does the concentration of fertility together with orientation of daughters on their mothers' family size affect the level of fertility?', Draft Working Paper (Laxenburg, Austria: International Institute for Applied Systems Analysis, 1988).

the next generation. To make this point clearer we may think of the extreme theoretical case that every daughter will have the same number of children as her mother. If the parity distribution were completely even, i.e. every woman had the same number of children, then the level of fertility would not change from one generation to the next. If, however, the distribution had some variance and consequently the mean sibship size of the daughters would be higher than the mean parity of the mothers, then the level of fertility would increase from each mother's generation to daughter's generation by exactly the difference between the two means. This model has been generalized by Lutz and Pullum[34] for the more realistic cases of only weak, positive orientation instead of perfect replication of the mothers' family size. The fact that the empirically observed level of fertility does not increase in most countries despite observed weak orientations of daughters' family sizes on their mothers' family sizes and observed variance in the distribution can then only be due to a declining trend in fertility levels induced by the numerous other fertility determinants. In other words, without this small positive effect of the relative variance in parity distributions, the decline would have been even stronger.

Another more obvious consequence of the distributional aspect of fertility lies in the degree of kin availability for the elderly. Especially in an aging population one of the major social concerns is the care for the increasing number of elderly people. And the care provided by family members—mostly daughters—plays a crucial role in most societies. This is where the distribution of children becomes very important. Obviously, the number of elderly without any living children is—even at a given level of fertility—much greater if the proportion of childless women and therefore the concentration of the distribution is greater. On the other hand, if the fertility pattern were very homogeneous and every woman had e.g. two children, then the problem of elderly without living children or siblings would be almost non-existent. Especially in some Asian countries where elderly are largely dependent on family support, this aspect is of utmost importance.

Other important consequences of family size distributions lie in the areas of housing demand and consumer goods. Aside from general trends in the level of fertility it makes a difference for the structure of housing demand whether there are many childless families and at the same time a number of very large families or all families had about the same size. Parity distributions also matter for the demand for durable consumer goods directed to children (e.g. toys, children furniture, etc.). The demand for such goods will be greater in the case of homogeneity where every family will buy the good, than in the case of some large families that can use the same goods for all their children. More significant on the

[34]Lutz and Pullum, *op. cit.*, in footnote 33.

structure of consumer goods demanded than the above mentioned aspect might be the effect of children on the per capita income of the family and the resulting inequality in economic standing.

Many other consequences of the distributional aspect of fertility patterns could be identified in areas that go as far as individual socialisation in the family where it seems to make a difference whether one is a single child or has many brothers and sisters. The major point of this discussion, however, should not be a complete list of consequences of fertility distributions but rather the message that distributional aspects indeed have some impact and make a difference on many questions in addition to the undoubtedly great importance of the average level of fertility.

Much further research on parity distributions is needed. One methodological question that would merit further exploration is the modeling of parity distributions and description of the function in terms of some parameters. Pullum *et al.*[35] have suggested a method based on the Brass relational logit model that focuses on the parity attainment proportion, a function which is equivalent to the $l(i)$ function in our life table notation above. For completed parity distributions of the U.S. cohorts born 1873 to 1933 they find the existence of a formal continuity among the successive distributions. However, for the 54 WFS distributions studied here, logit transformations of the $l(i)$ functions for many countries did not come sufficiently close to linearity and hence resulted in a very heterogeneous picture. This indicates that for a global analysis of parity distributions from very different societies, models should have a higher degree of differentiation possibly with different standard functions such as in the case of regional model life tables.

Finally, the above analysis shows that the extent of concentration of fertility or the "division of labor" for society's reproduction is far from being a universal constant.[36] Our study indicated, however, that over the course of demographic transition there seems to be a regular pattern of increasing concentration with declining fertility levels. The exceptional case of China once more proves that this is not a demographic automatism but is highly dependent on the structure of society and its heterogeneity, not only in socioeconomic terms but also with respect to its value system. These questions seem to merit much further analysis especially on the level of subnational populations differentiated by

[35]Th. Pullum, L. Tedrow, and J. Herting, 'Change and continuity in completed parity distributions in the United States, birth cohorts of white women: 1871–1935', Manuscript submitted to *Demography*.

[36]Vaupel and Goodwin, *op. cit.*, in footnote 24 mention selected pieces of evidence that might imply the existence of a universal constant of about 25% of the women having half the children. But as they also point out, these seem to be points on a complicated pattern and not instances of a universal demographic constant.

ethnic, regional, religious, or socio-economic criteria. Reproductive heterogeneity between such groups with inheritable characteristics is a major determinant of the future population composition.

Appendix Tables

Table A.1 $D(i)$ for all countries, some schooling.

Country	F(0)	Completed parity distribution (per 1000) 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AFRICA																	
Egypt	6.37	40	38	61	68	67	110	119	118	102	104	72	38	31	10	10	3
Ghana	5.97	25	19	76	44	141	96	153	115	141	128	44	12				
Kenya	8.10	14	17	11	28	28	53	99	99	176	164	124	90	51	28	11	
Lesotho	5.34	46	75	84	96	107	101	113	119	105	75	32	17	19	5		
Mauritania	6.06	46	52	64	73	67	99	111	149	99	96	67	38	20	11		
AMERICAS																	
Colombia	5.94	32	54	80	109	105	98	98	102	76	58	72	47	36	18	7	
Costa Rica	5.68	37	45	103	156	128	78	88	75	75	47	45	25	42	20	12	17
Dominican Rep.	5.48	45	58	91	111	143	84	156	32	58	52	84	25				
Ecuador	5.73	26	35	102	120	113	120	91	102	85	72	41	30	30	21	4	
Mexico	6.70	35	47	65	76	79	84	104	89	83	106	66	57	39	32	11	20
Panama	4.97	43	47	112	129	125	162	98	84	80	43	43	24	6			
Paraguay	4.91	29	74	122	208	95	107	86	56	71	44	35	32	26	8		
Peru	5.93	21	45	75	125	117	113	106	98	72	71	47	51	17	14	10	10
USA	4.33	52	76	238	248	152	120	46	32	17	10	10					
Venezuela	5.11	28	51	136	113	125	119	113	130	45	51	34	39	11			
ASIA AND PACIFIC																	
Bangladesh	7.13	13	20	53	60	33	107	174	127	174	53	67	46	6			
Fiji	6.01	56	40	66	66	68	110	122	136	107	94	71	35	11	7	4	
Indonesia	5.65	58	55	72	90	92	116	114	94	111	63	51	48	24	4		
Jordan	7.29	23	9	37	61	94	61	142	104	75	127	104	37	47	52	18	
Korea	4.98	10	43	61	101	177	217	162	130	55	22	13	2				
Malaysia	5.72	27	59	91	101	103	107	103	94	68	75	36	22	5			
Philippines	6.53	23	35	52	73	98	97	121	114	101	99	75	51	30	15	4	5
Sri Lanka	5.41	43	49	86	98	115	107	141	123	87	56	43	30	7	7	1	
Syria	6.21	53	29	23	88	76	142	147	71	136	71	65	59	29	5		
Thailand	6.29	23	43	59	73	97	115	113	116	99	93	79	37	31	11	4	
Turkey	4.51	37	37	146	183	158	141	91	62	52	42	24	17	4			

Table A.1 Continued.

Country	F(0)	Completed parity distribution (per 1000) 0	1	2	3	4	5	6	7	8	9	10	11
EUROPE													
Belgium	3.51	83	184	307	201	112	45	43	16	5	3		
Czechoslovakia	3.20	33	190	485	187	67	21	15	3				
Denmark	3.37	23	121	494	241	80	29	11					
Finland	3.34	51	172	389	245	102	26	4	4	2	2	2	
France	3.37	72	152	348	290	80	29	14	14				
Great Britain	3.49	73	137	347	238	131	36	22	12	2			
Italy	3.01	84	189	441	217	63	7						
Netherlands*	2.58	220	240	300	220	20							
Norway	3.64	50	112	320	276	161	71	9					
Poland	3.16	30	223	471	179	57	21	11	3	2	3		
Portugal	2.25	70	239	373	159	79	31	26	8	6	2	1	
Spain	4.16	26	74	286	265	169	95	58	5	11	5	5	
Yugoslavia	2.85	69	224	552	121	17	9	9					

*In this context the Dutch data are not strictly comparable to the other countries because they are restricted to the marriage cohorts 1963–1973.

Table A.2 $D(i)$ for all countries, no schooling.

Country	F(0)	Completed parity distribution (per 1000) 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AFRICA																	
Egypt	6.82	37	28	35	35	75	101	117	139	128	102	103	39	31	11	5	5
Kenya	7.59	37	26	27	32	34	57	80	125	136	151	135	73	46	20	9	3
Mauritania	5.92	47	44	78	95	116	105	88	98	51	119	40	47	54	10		
AMERICAS																	
Colombia	7.37	26	30	43	75	74	89	75	91	102	87	85	83	41	36	36	20
Costa Rica	8.27	18	25	38	54	49	67	87	77	85	98	93	85	74	64	28	51
Dominican Rep.	6.87	51	61	40	61	92	78	75	71	98	85	71	71	75	54	9	
Ecuador	8.01	11	18	20	36	77	77	100	91	108	117	100	81	68	41	22	24
Guyana	7.33	29	37	29	44	59	66	133	96	140	96	88	59	59	37	22	
Mexico	7.68	40	18	38	34	72	78	68	110	114	108	92	70	60	46	24	22
Panama	7.14	16	32	52	64	60	84	119	119	92	79	91	80	79	23	3	
Paraguay	7.43	27	42	60	60	55	78	60	93	103	93	98	85	60	37	17	25
Peru	7.79	23	23	23	31	49	67	102	118	130	128	99	70	83	26	10	11
Trinidad & Tobago	6.21	40	40	32	96	80	104	120	193	48	64	96	48	31			
USA	5.12	81	40	212	131	152	81	111	61	51	51	30					
Venezuela	7.39	12	36	66	54	72	90	72	66	90	108	132	84	60	36	17	
ASIA AND PACIFIC																	
Fiji	6.64	43	40	37	78	72	83	95	104	132	98	92	66	43	11		
Jordan	9.12	23	10	15	15	25	35	50	86	92	146	148	138	82	65	37	25
Korea	4.75	19	47	64	121	191	216	143	105	58	19	8	2				
Malaysia	6.35	30	44	56	80	90	101	104	113	106	95	67	55	32	10	4	4
Philippines	7.73	28	22	22	49	37	60	86	89	141	170	128	67	44	33	11	6
Sri Lanka	6.46	21	59	56	68	62	97	137	106	95	126	67	48	29	10	7	3
Thailand	6.36	32	35	53	62	103	77	124	124	124	118	74	35	20	11		
Turkey	7.00	21	5	36	56	93	123	106	142	98	106	75	53	36	19	15	7

Table A.2 Continued.

Country	F(0)	Completed parity distribution (per 1000)													
		0	1	2	3	4	5	6	7	8	9	10	11	12	13
EUROPE															
Belgium	3.52	66	241	277	192	102	54	34	19	2	7	5			
Czechoslovakia	3.53	54	102	367	279	136	54	7							
Denmark	3.62	80	112	310	241	181	34	23	11	6					
Finland	3.93	46	126	291	244	130	88	36	21	8	8	4			
France	3.87	52	161	286	194	145	69	48	28	4	4	8			
Great Britain	3.80	28	146	363	170	146	80	42	14	9					
Italy	3.50	49	164	369	232	105	46	13	9	6	7				
Netherlands*	2.85	77	385	308	115	77	38								
Norway	3.88	44	71	257	310	221	97								
Poland	4.13	32	88	287	252	168	82	48	21	11	11	2			
Portugal	3.49	48	136	264	163	121	76	58	49	30	14	14	10	6	3
Spain	4.06	43	81	293	257	167	74	40	26	10	6	3			
Yugoslavia	4.17	41	112	332	188	118	62	56	44	23	24				

*In this context the Dutch data are not strictly comparable to the other countries because they are restricted to the marriage cohorts 1963–1973.

Table A.3 $D(i)$ for all countries, rural.

Country	F(0)	Completed parity distribution (per 1000)															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AFRICA																	
Benin	6.22	28	30	52	72	92	98	120	138	152	112	56	34	10	1		
Egypt	6.98	42	29	37	35	64	92	94	136	125	118	111	49	34	14	9	3
Ghana	6.57	21	13	43	65	84	107	139	131	133	116	86	37	6	10	1	
Ivory Coast	6.85	43	47	40	40	61	81	92	105	138	143	89	71	23	10	7	2
Mauritania	6.03	36	46	64	83	90	114	111	135	75	109	44	46	36	5		
Morocco	7.65	59	15	36	34	44	58	77	89	138	124	117	72	72	28	18	12
Senegal	7.02	33	31	40	53	63	65	87	114	142	140	99	95	27	4		
Sudan	5.98	79	54	74	59	61	69	101	123	130	91	83	44	19	7		
Tunisia	6.90	36	23	18	43	65	96	131	138	118	156	80	55	33	3		
AMERICAS																	
Colombia	7.63	27	27	44	57	64	91	88	94	84	84	84	94	44	44	40	27
Costa Rica	8.49	21	21	29	42	53	66	84	76	92	92	95	87	74	71	37	53
Dominican Rep.	7.75	33	23	37	61	71	52	94	66	80	104	85	123	94	52	18	
Ecuador	7.81	13	18	28	50	63	84	108	104	99	117	89	71	65	42	18	24
Guyana	7.10	37	48	37	48	48	87	115	95	128	97	83	60	56	33	13	7
Haiti	6.12	28	55	39	73	89	110	131	115	125	115	70	36	7			
Jamaica	6.15	72	60	82	52	82	75	75	115	100	77	85	57	22	12	17	7
Mexico	7.91	30	21	23	37	57	62	84	101	118	124	106	91	62	43	23	11
Panama	6.87	26	13	53	83	70	104	90	144	87	80	87	73	60	20	3	
Paraguay	7.48	27	54	59	66	39	38	66	98	91	91	86	93	76	36	17	27
Peru	7.54	29	30	21	34	48	75	109	110	127	133	92	79	71	19	9	4
Trinidad & Tobago	6.01	58	62	68	58	100	100	117	103	65	79	68	62	24	27	3	

Table A.3 Continued.

Country	F(0)	Completed parity distribution (per 1000)															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ASIA AND PACIFIC																	
Fiji	6.66	54	32	45	59	59	82	105	121	131	118	83	50	30	7	9	7
Korea	6.13	10	29	31	28	99	156	194	197	137	61	32	16	5			
Malaysia	6.30	32	48	61	73	84	103	100	117	110	93	82	54	26	9	3	
Pakistan	6.91	31	22	37	51	52	97	96	158	146	119	93	40	31	14	4	
Philippines	7.25	26	27	35	52	57	74	115	104	118	140	105	65	37	24	7	6
Syria	7.80	24	11	31	37	44	57	102	128	138	125	95	89	61	27	13	11
Turkey	7.07	20	11	28	64	85	130	104	109	105	113	89	62	33	16	17	6
EUROPE																	
Belgium	3.63	44	186	336	168	124	88	44	9								
Czechoslovakia	3.63	32	77	423	288	103	38	32	6								
Denmark	3.88	50	124	174	331	231	50	41									
Finland	4.00	40	102	284	273	138	89	31	24	7	7	2	2				
France	3.87	60	121	259	267	147	60	60	26								
Italy	3.40	45	178	374	243	112	16	16	4	2	8						
Netherlands*	2.95	190	238	143	286	143											
Norway	3.87	51	83	273	269	209	91	24									
Poland	4.40	21	66	237	276	183	97	66	25	16	12						
Portugal	3.29	51	151	277	175	115	66	51	43	24	12	11	10	5	3		
Spain	4.20	65	75	239	259	154	90	60	35	20	5						
Yugoslavia	4.48	42	104	276	178	133	74	74	51	31	37						

*In this context the Dutch data are not strictly comparable to the other countries because they are restricted to the marriage cohorts 1963–1973.

Table A.4 $D(i)$ for all countries, urban.

Country	F(0)	Completed parity distribution (per 1000)															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AFRICA																	
Benin	5.83	44	12	95	63	146	63	121	159	108	89	38	50	6			
Cameroon	3.89	148	151	111	97	1	61	129	86	83	68	0					
Egypt	6.24	33	35	56	64	81	119	148	125	109	84	67	24	28	6	5	6
Ghana	5.87	29	37	74	67	123	78	119	156	141	93	55	18	3			
Ivory Coast	6.50	32	64	50	55	69	60	111	115	129	157	60	74	18			
Mauritania	5.93	64	52	80	84	88	84	84	112	80	104	72	36	36	20	0	
Morocco	6.30	83	66	44	49	51	55	122	109	107	113	96	51	36	10	2	
Senegal	6.69	39	62	51	28	90	73	79	125	130	96	85	68	56	11		
Sudan	6.10	64	38	51	84	90	97	84	103	129	77	103	45	25			
Tunisia	6.63	36	19	41	54	79	117	122	128	128	112	66	41	28	14	8	1
AMERICAS																	
Colombia	6.51	29	45	62	103	96	92	80	94	98	72	78	56	37	21	17	13
Costa Rica	5.36	35	50	112	167	125	80	92	77	70	54	45	25	44	14	4	
Dominican Rep.	5.23	63	92	75	92	143	105	109	50	88	46	46	33	25	25	0	
Ecuador	5.94	24	35	95	104	131		113	82	86	95	71	53	42	33	20	8
Guyana	5.21	87	94	62	118	97	80	80	104	59	87	66	24	31	3		
Haiti	4.76	50	79	123	130	137	115	72	94	72	50	43	28				
Jamaica	4.28	76	132	108	108	148	96	76	84	96	36	24	11				
Mexico	6.43	42	48	78	79	90	96	96	94	77	94	53	41	35	32	10	27
Panama	4.94	38	61	117	122	124	156	115	63	81	38	40	22	11	4		
Paraguay	4.74	30	61	126	206	116	119	80	49	86	46	49	21	6			
Peru	6.25	17	38	71	115	112	104	101	105	79	72	56	46	31	19	10	15
Trinidad & Tobago	5.18	58	69	85	133	117	96	117	82	98	32	34	19	32	15	4	

Table A.4 Continued.

Country	F(0)	Completed parity distribution (per 1000) 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ASIA AND PACIFIC																	
Fiji	5.59	46	53	74	87	87	133	125	130	89	56	69	38	7			
Indonesia	5.32	82	76	85	74	105	91	94	119	85	65	56	37	19	5		
Korea	4.75	19	47	64	121	191	216	143	105	58	19	8	2				
Malaysia	5.67	23	55	85	118	117	107	112	96	86	70	50	36	33	6		
Pakistan	6.77	52	45	31	49	70	59	101	126	129	115	101	66	38	10		
Philippines	6.00	21	40	61	96	131	115	104	114	100	74	57	36	26	13	4	
Sri Lanka	5.11	26	72	121	101	89	112	179	104	80	49	34	23	5			
Syria	7.53	48	16	14	46	44	87	113	80	141	104	117	78	46	24	20	13
Thailand	5.02	19	64	103	84	214	110	116	90	77	71	32	12				
Turkey	4.82	35	24	138	153	159	130	97	118	49	43	14	12	14	8		
EUROPE																	
Belgium	3.54	79	216	283	200	103	46	37	19	4	6	3	1	3			
Czechoslovakia	3.20	42	201	461	180	78	26	5	0	5	0	3					
Denmark	3.43	64	114	431	215	121	27	12	10	2	0	2					
Finland	3.40	55	180	378	220	102	36	15	4	4	4	4					
France	3.59	59	175	331	212	112	52	26	22	4	0	7					
Italy	3.31	69	167	403	220	82	36	5	9	6	3						
Netherlands*	2.56	164	309	364	145												
Norway	3.64	42	121	332	295	126	58	16	0	11							
Poland	3.35	38	188	436	190	88	33	13	7	1	5	2	0	1			
Portugal	2.25	71	247	385	133	76	36	28	6	8	1	3					
Spain	4.07	36	81	306	255	168	74	39	20	8	6	4	3	0	1		
Yugoslavia	3.67	44	137	419	187	89	40	32	31	12	8						

*In this context the Dutch data are not strictly comparable to the other countries because they are restricted to the marriage cohorts 1963–1973.

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