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How Fast is Fertility Declining in Botswana and Zimbabwe?

Duncan Thomas
Ityai Muvandi

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Duncan Thomas is a senior economist at RAND Corporation and an associate professor at UCLA. Ityai Muvandi is a researcher at the Center for African Family Studies in Nairobi, Kenya.

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FOREWORD

The 1986 World Bank Policy Study on *Population Growth and Policies in Sub-Saharan Africa* underscored the negative consequences of rapid population growth for the region and the need to reduce fertility and mortality to raise the quality of life. The last decade has seen a heightened commitment to the development of national population policies and to the provision of family planning services.

While fertility remains high across most of the continent, there are signs that the demographic transition is under way in at least three countries that have achieved relatively higher levels of female schooling and greater access to modern methods of contraception — Botswana, Zimbabwe and Kenya. According to the results of demographic surveys conducted in 1984 and 1988 in each country, there would appear to have been a dramatic drop in fertility in Botswana and Zimbabwe over just four years. This paper on the demographic transition in Southern Africa looks more closely at the results of the two surveys in Botswana and Zimbabwe and finds that fertility has indeed declined, but less than commonly thought. At least part of the decline in fertility between surveys can be attributed to differences in sampling. In particular, women interviewed in the 1988 surveys had higher levels of schooling than the same cohort five years earlier. This is even true of older women who were unlikely to have obtained additional schooling. Since higher education is usually correlated with lower fertility, this would explain part of the observed decline in total fertility rates. There is also evidence that methodological differences in the two surveys could be responsible.

This paper is one of several products of the World Bank research project on "The Economic and Policy Determinants of Fertility in Sub-Saharan Africa", sponsored by the Poverty and Human Resources Division of the Africa Technical Department and managed by Martha Ainsworth, principal investigator. It is also part of a broader research effort in the Poverty and Human Resources Division of the Policy Research Department that examines the role of human resources in economic development.

We hope that this study will improve the understanding of the demographic situation in Botswana and Zimbabwe and suggest promising areas for future analysis and actions on reducing fertility and raising contraceptive use.

Kevin Cleaver
Director
Africa Technical Department

Lyn Squire
Director
Policy Research Department

ABSTRACT

Botswana and Zimbabwe have been acclaimed as being on the vanguard of the demographic transition in sub-Saharan Africa. Key data that are cited to support this claim are the Contraceptive Prevalence Surveys (CPS) and Demographic Health Surveys (DHS) which were conducted in both countries. This paper examines the comparability of these data sources and finds that at least part of the observed decline in aggregate fertility rates in both countries can be attributed to differences in sample composition. In Botswana and Zimbabwe, women of the same cohort are better educated in the second survey relative to the first. Since education and fertility are negatively correlated, this fact explains part — but not all — of the observed fertility decline across the surveys. For example, it accounts for up to half the decline among the cohort of women aged 25 to 34 in 1984 in Zimbabwe. The DHS included a complete birth history whereas the CPS asked only summary questions about the number of children ever born. There is evidence that differences in the structure of the instruments also raise questions about the comparability of the two data sources.

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1. INTRODUCTION

Fertility in sub-Saharan Africa remains the highest in the world and there is little evidence that the kind of sustained declines in fertility that have been observed in all other developing areas are imminent for most countries on the sub-continent. Some recent evidence, however, has led several researchers and policy makers to argue that the demographic structure of a few societies in the region may be on the verge of dramatic change. In particular, Botswana, Zimbabwe, and sometimes Kenya, are frequently cited as the exceptions to an otherwise dismal picture of stable fertility rates in the region. (See, amongst others, Mhloyi 1988; World Bank 1989; Freedman and Blanc 1992; van de Walle and Foster 1990; Ainsworth, Beegle and Nyamete 1994).

Evidence for dramatic fertility decline in Botswana and Zimbabwe appears to be drawn from Censuses and two recent nation-wide demographic surveys conducted in each country, the first as part of the Contraceptive Prevalence Survey (CPS) programme and the second in the Demographic and Health Survey (DHS) programme. Since it is well known that Census data are potentially subject to important biases for the estimation of fertility trends, it would seem that the weight of the evidence used to draw inferences regarding fertility trends in Botswana and Zimbabwe comes from the two recent demographic surveys.[1] Indeed, these surveys, which have been have been conducted in a large number of countries, have made a substantial contribution to the knowledge base regarding fertility, child survival, contraception, and maternal and child health throughout the world.

In this paper, the CPS and DHS data from Botswana and Zimbabwe are re-examined. There has been some discussion of puzzles that have appeared in tabulations of these data (see van de Walle and Foster 1990, for example) although it was only recently that all four datasets were released to the public domain so that they may be compared at the micro-level.

This turns out to be a useful comparison. There is some evidence that at least part of the observed decline in aggregate fertility rates in both Botswana and Zimbabwe can be attributed to differences in the sample composition. It has been pointed out, for example, that the Zimbabwe CPS tended to under-represent women at either end of the age distribution (World Bank 1989) and there is evidence that the DHS suffered from the same problem. There also appears to be substantial under-reporting of fertility by older women in the second Botswana survey (van de Walle and Foster 1990).

Evidence is presented here for both Botswana and Zimbabwe which indicates that relative to the CPS, women in the DHS tend to be better educated. This does not simply reflect the fact that younger women have more education than older cohorts: women of

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1. This is especially true in Zimbabwe where data from two Censuses are usually cited; the 1969 Census is generally recognized as being of limited value to policy makers in post-Independence Zimbabwe. There is also some debate regarding the quality of the 1982 Census which was conducted soon after Independence.

the *same* cohort are better educated in the second survey, relative to the first. One of the few facts that social scientists agree on is that there is typically an inverse correlation between education and fertility. Part of the observed decline in fertility can apparently be accounted for by the shift in the distribution of education of the same cohort of women across the two surveys. The results presented below also *suggest* that differences in the design of the fertility questions in the CPS and DHS may further contaminate inferences drawn from aggregate statistics. While there is certainly evidence for some decline in fertility in both Botswana and Zimbabwe, the evidence for dramatic decline, based on these data, is rather less clear.

2. DATA

As part of the Contraceptive Prevalence Survey programme, the first wave of the *Botswana Family Health Survey-I* (BFHS-I) was conducted in 1984 by the Central Statistics Office in collaboration with the Institute for Resource Development (IRD).[2] Drawing a nation-wide sample of 3,064 women aged 15 through 49, the survey collected information on fertility, contraception, child survival and some socio-demographic characteristics of the woman (Manyeneng and others 1985).

Four years later, in 1988, the same agencies collaborated in the collection of the second wave of the *Botswana Family Health Survey-II* (BFHS-II), which formed part of the worldwide *Demographic and Health Surveys*. This survey was both more extensive (with a sample size of 4,368) and also considerably more comprehensive. In addition to the information collected in BFHS-I, the second wave collected detailed information on maternal and child health, breastfeeding and contraceptive histories (Central Statistical Office 1989).

Two similar surveys were conducted in Zimbabwe during the same period. The CPS, called the *Zimbabwe Reproductive Health Survey* (ZRHS), was carried out in 1984 by the Zimbabwe National Family Planning Council in collaboration with IRD and covered 2,574 women (Zimbabwe National Family Planning Council 1985). In 1988, the Central Statistical Office and IRD implemented the *Zimbabwe Demographic and Health Survey* (ZDHS) which had a substantially larger sample of 4,201 women (Central Statistical Office 1989).

Although in most respects the 1984 and 1988 surveys in each country are broadly comparable, there is a key difference between them that may be important for a study of fertility. In the 1984 surveys, each woman was asked about children to whom she had given birth (living at home and away) and those that died. In the 1988 surveys, however, after eliciting that information, the enumerator asked each woman to provide a complete birth history covering every child. If there was a discrepancy between the number of birth history entries and the original tally of children born, the enumerator was instructed to reconcile the difference.[3]

This caveat notwithstanding, these data offer an unique opportunity to examine the dynamics of fertility change in Botswana and Zimbabwe. In particular, they afford the researcher the luxury of being able to cross-check estimates for consistency without having to make strong assumptions about the underlying data generating process. There can be little doubt that the availability of these surveys has already had a substantial impact on the understanding of demographic processes in Southern Africa; as additional

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2. IRD/Macro Systems was named Westinghouse Public and Applied Systems at the time.

3. Unfortunately, on the data tapes used for this study, we are unable to identify whether such discrepancies arose or how they were resolved. An examination of these data may be a valuable exercise in and of itself.

data become available at the micro-level, further analyses along these lines will presumably add to this understanding.

The aim of this paper is quite simple: to determine the extent to which the observed dramatic decline in fertility in Botswana and Zimbabwe reflects reality as opposed to differences across the surveys.

3. THE EVIDENCE

Table 1 presents some summary statistics regarding fertility and sample composition from the four surveys: the 1984 ZRHS, the 1988 ZDHS, the 1984 BFHS-I and the 1988 BFHS-II.[4] The story they tell is fairly well known. The total fertility rate (TFR) in Zimbabwe was estimated to be about 6.5 in 1984 and declined by one child to 5.5 by 1988. The average woman had borne 3.4 children according to the 1984 survey and almost one half a child less, 2.95, in the 1988 survey. Completed fertility, as measured by the number of children ever born to women aged 45 to 49, fell from 7.5 in 1984 to 6.9 in 1988, suggesting that much of the decline in fertility has been concentrated among younger women.

These declines in fertility have occurred in the context of rising child survival rates as well as increasing knowledge and use of modern contraceptives (see Table 1). Knowledge of modern methods is virtually universal in Zimbabwe today. The usage rate among all (married and unmarried) women has risen by almost 20 percent, from 23 percent in 1984 to 27 percent in 1988. These increases are probably a reflection of both successful family planning and public health programs (Boohene and Dow 1987), as well as broader social changes that have taken place in the country since Independence in 1980.[5] Massive spending on social services by the government is surely partly responsible for this change;[6] Zimbabwe has registered very impressive successes in increasing access to both the health care system and public education. For example, between 1980 and 1986, primary school enrollment ratios rose by over 40 percent. The vast majority of the people of Zimbabwe were excluded from secondary schools prior to Independence; at that time, only 8 percent of eligible children were enrolled. These enrollments have increased by almost six fold, to 46 percent by 1986. The number of tertiary students has tripled during the same period and, unlike many developing countries, the vast majority (over 70 percent) of these students are in education, science and teacher training (UNESCO 1986). These increases are also reflected in the demographic surveys; in 1984, the average woman had 4.9 years of schooling whereas by 1988 she had over six years.

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4. The BFHS I and II as well as the ZRHS estimates are all weighted to account for different sampling proportions (of rural and urban households) included in the surveys; the ZDHS is a proportional probability sample. As a matter of fact, the essence of the results are independent of whether or not weights are applied.

5. Zimbabwe is often cited as having a very successful family planning programme. Family planning services were first introduced in Zimbabwe in 1953 and they have been, at least since 1966, an integrated component of the public health system. In 1984, family planning services were reorganized and the Zimbabwe National Family Planning Council was formed as a parastatal operating under the Ministry of Health.

6. In 1989, government spending as a proportion of GNP was high (40 percent). Almost one quarter of public spending went to education, while the health sector received 7.6 percent of the public budget.

TABLE 1: *FERTILITY, CONTRACEPTIVE USE AND SOCIO-DEMOGRAPHIC CHARACTERISTICS*
Means and [standard errors].

1. ZIMBABWE: Reproductive and Demographic and Health Surveys

	ZRHS 1984		*ZDHS* 1988	
Fertility				
Total # children ever born	3.40	[.06]	2.95	[.05]
Completed fertility (45-49)	7.46		6.87	
Total fertility rate	6.5		5.5	
Child survival rate	90.3		92.0	
Contraceptives: % of all women who				
Know of modern method	81.1		95.4	
Currently use modern method	22.8		27.2	
Socio-demographic characteristics				
Age	28.02	[.18]	27.82	[.15]
Years of education	4.92	[.07]	6.06	[.06]
Sample size	2574		4201	
Ever had child	2014		3005	

2. BOTSWANA: Family Health Surveys

	BFHS-I 1984		*BFHS-II* 1988	
Fertility				
Total children ever born	3.05	[.05]	2.58	[.04]
Completed fertility (45-49)	6.85		5.75	
Total fertility rate	6.5		5.0	
Child survival rate	90.8		93.9	
Contraceptives: % of all women who				
Know of modern method	65.5		95.1	
Currently use modern method	16.1		28.9	
Socio-demographic characteristics				
Age	28.28	[.17]	27.68	[.14]
Years of education	4.40	[.07]	5.48	[.06]
Sample size	3064		4368	
Ever had child	2414		3279	

Taking a longer perspective on fertility, however, there appear to be some puzzles. According to Census data, the total fertility rate in Zimbabwe declined from 6.7 to 5.6 between 1969 and 1982; it then rose to 6.5 in 1984 and had fallen back to the 1982 level by 1988. Apart from young women (aged 15 to 19), age-specific fertility rates in 1982 and 1988 are very close, whereas those in 1969 are substantially higher for every age group. This would be consistent with a decline in fertility during the 1970s and a levelling off in the 1980s.

Estimated age-specific fertility rates based on the 1984 survey, however, are rather different. They are higher than the 1982 and 1988 estimates for all women under 40 and are, in fact, 40 percent higher for women aged 35 to 39. For older women, the reverse is true. Based on the 1984 survey, estimated fertility rates of women aged 45 to 49 were only one third of the comparable estimates in both the 1988 and 1982 datasets.

It is generally thought that Census data tend to underestimate fertility as women are inclined to fail to recall births several years ago and, especially, those that involved early mortality. There are, by now, many potential indirect methods which seek to adjust fertility (and mortality) data to account for recall error. The World Bank (1989) has applied the Brass (1968) P/F method to evaluate the internal consistency of the four data sources and argues that there was indeed substantial under-reporting of fertility in the two Censuses and thus calculated adjusted fertility rates (reported in Table 2). According to these adjusted data, the "national total fertility rate was close to 8 in the late 1960s, ... it then fell to around 7 by 1981/82, to around 6.5 by 1983/84 and to an average of 5.7 around 1986"[7] (World Bank 1989; see, also, Mhloyi 1988). Researchers and policy makers have, therefore, come to the conclusion that there is evidence for significant fertility decline in Zimbabwe during the 1980s.

Turning next to Botswana, according to the 1981 Census, the total fertility rate was about 7.1; it had declined to 6.5 by 1984 (according to the first wave of the BFHS) and collapsed to 5.0 by 1988 (BFHS II). If these data reflect reality, then fertility has declined by over 25 percent in only 7 years and much of this decline is also concentrated in the later part of the eighties. Furthermore, as in Zimbabwe, the number of children born to the average woman declined by almost half a child (from 3.1 to 2.6 children) and the completed fertility rate dropped by over a child, from 6.9 to 5.8, suggesting that the reductions in fertility are also concentrated among younger women. For a discussion of and economic explanation for fertility change in Botswana, see Rutenberg and Diamond (1993).

The Botswana Maternal Child Health/Family Planning Unit was formed in 1973 within the Ministry of Health, but it has been during the 1980s that public investment in family planning has grown most rapidly — especially since 1984, when the first BFH survey was fielded. The evidence suggests these investments have had a high rate of

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7. The authors do not discuss the rather surprising fact that among old women, even according to the adjusted numbers, fertility declined between 1982 and 1984 but then rose by 1988.

TABLE 2: *AGE-SPECIFIC FERTILITY RATES — ZIMBABWE*

	Census 1969		*Census 1982*		*ZRHS 1984*		*ZDHS 1988*	
Age	*Unadj*	*Adj*	*Unadj*	*Adj*	*Unadj*	*Adj*	*Unadj*	*Adj*
15-19	.08	.12	.09	.13	.13	.16	.10	.13
20-24	.27	.35	.26	.33	.29	.30	.25	.26
25-29	.30	.37	.25	.32	.30	.30	.25	.26
30-34	.26	.31	.23	.38	.26	.26	.22	.22
35-39	.22	.26	.17	.21	.22	.21	.16	.16
40-44	.15	.16	.09	.11	.09	.08	.09	.09
45-49	.07	.08	.04	.04	.11	.01	.04	.03
TFR	6.7	8.2	5.6	7.1	6.5	6.5	5.7	5.5

Sources: Central Statistical Office 1985; Johansson 1989; Zimbabwe National Family Planning Council 1985; *Zimbabwe Central Statistical Office 1989;* World Bank 1989. All adjusted numbers are drawn from World Bank 1989, Table 11. 1969 and 1982 adjustments based on P/F ratios; 1984 and 1988 are adjusted for true age-group.

return. Knowledge of contraceptives has increased by 50 percent: in 1984 about two-thirds of women knew about modern methods and by 1988 that proportion had increased to 95 percent. As in Zimbabwe, knowledge of modern methods had become virtually universal by 1988. Use of these methods rose even faster, almost doubling during the four years between the two surveys from 16 percent to 29 percent. School enrollment rates also rose during this period[8] and this is reflected in the two surveys: the average woman had 4.4 years of schooling in 1984 and 5.4 in 1988, placing her slightly below the average Zimbabwean woman.

All of this evidence suggests that fertility has indeed declined dramatically in both countries during the four years between the two surveys. And several authors have heralded the onset of the (long-awaited) demographic transition in sub-Saharan (or at least Southern) Africa. Yet the final reports for both the ZDHS and BFHS II recommend caution in taking these declines at their face value (Botswana Central Statistics Office 1989; Zimbabwe Central Statistical Office 1989). Several reasons have been cited which suggest that following their advice would be prudent.

Recall that the 1984 surveys collected summary information on the number of children ever born whereas the 1988 surveys first asked each woman the number of children ever born and then obtained a birth history on each child. One might expect the

8. Secondary school enrollments rose by over a quarter from 25 percent in 1984 to 32 percent in 1988. In 1989, the share of the public budget spent on education and health (20 percent and 5.5 percent) was slightly less than in Zimbabwe but government spending accounted for a larger share of GNP (50 percent).

birth history method to result in less under-reporting but it has been argued that in fact, in Africa, birth histories tend to result in *lower* estimates of fertility (Government of Kenya 1989). Exactly why this should be so is not at all clear (van de Walle and Foster 1990); it is plausible that high parity women suffer from fatigue and so truncate their birth histories (and then reduce the total number of children born) or they may just get confused as they enumerate each child. It has also been noted that there is some slippage in the birth histories as respondents (or enumerators) appeared to mis-classify children as being older than 5 and thus not complete the child health module (Rutstein and Bicego 1990; Arnold 1992).

Furthermore, both the demographic surveys collected information on only woman aged 15 to 49 in each household. One might expect that young and old women would be mis-classified as being outside the admissible age range in order to reduce the interviewer's workload (Arnold 1992). There is some sense that this is indeed a problem in the Zimbabwe surveys since the age distributions of women indicate considerable under-representation by young women[9] and also in the Botswana DHS. The next section takes another look at the evidence to determine whether there might be other indications in the data that suggest prudence in inferring a time-series pattern from the two surveys.

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9. Whereas one quarter of women between 15 and 49 were aged 15 to 19 according to the 1982 Census and 1988 ZDHS, this age group accounted for only 20 percent of women in the 1984 ZRHS. The 1987 Intercensal Demographic Survey (Central Statistics Office, 1991) collected information on some 29,000 women aged 12 and above; these data should not be subject to end-point problems at 15 or 49. According to the 1987 data, 27 percent of the 15 to 49 year old women were aged between 15 and 19 suggesting that young women were mis-classified in the ZDHS as well.

4. THE EVIDENCE — ANOTHER LOOK

Table 3 presents the age-specific number of children reported to have been ever born to women in Zimbabwe (in the upper panel) and Botswana (in the lower panel). Column 1 is based on the 1984 survey and column 3 on the 1988 survey. According to these numbers, there have been significant declines in fertility in Zimbabwe in *every* age group with the largest declines being in the early ages. Similarly, in Botswana, significant reductions in fertility are registered for every age group, apart from the youngest (among whom fertility has not changed significantly and is slightly higher in the second survey although this may simply reflect sampling variation). Based on these data, one might also infer that women tend to complete their fertility around age 40 in both countries since the number of children ever born to women aged 35-39 in 1984 (5.36 in Botswana) is only slightly less than the average number born to women aged 40-44 in 1988 (5.43 in Botswana; the comparable numbers in Zimbabwe are 6.2 and 6.4, respectively). This inference may, however, be misleading since reported fertility for the next cohort of women (aged 40-44 in 1984) actually *declined* during the four years between the surveys, from 6.3 to 5.8 in Botswana and from 7.0 to 6.9 in Zimbabwe.[10] Pointing out this fact in Botswana, van de Walle and Foster (1990) attribute it to misreporting and suggest it reflects differences in the methods used to collect fertility data in the two sets of surveys.[11] Given the fact that the anomaly arises in both countries, this seems an appealing hypothesis.

The study next exploits the birth history information in the 1988 surveys. The number of children each woman reported she had borne as of 1984 is calculated and her age is set to the level it would have been in 1984. These estimates of her fertility by 1984, based on the 1988 data, are reported in column 2 of Table 3 (labelled ZDHS 1984 and BFHS-2 1984 for Zimbabwe and Botswana respectively). Columns 1 and 2 are, therefore, estimates of the same thing: the average number of children born to a woman of a particular age (group) as of 1984. In an ideal world, they would be identical (apart from sampling variation).

On average, for women aged 15 through 44 (in 1984),[12] fertility is significantly lower in the 1988 survey relative to the 1984 survey in both Zimbabwe and Botswana. For example, in Zimbabwe, the 1984 survey estimates fertility in 1984 to be 3.1 children per woman, but only 2.8 at that time according to the 1988 survey. This difference accounts for 80 percent of the observed decline in the number of children ever born over the period 1984 to 1988. In Botswana, the difference between the estimates based on cohort adjustment (in column 2) is (slightly) greater than the difference between the observed number of children ever born in the two surveys and this is due to much

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10. This decline is significant in Botswana but not in Zimbabwe.

11. Recall summary data were collected in the 1984 surveys and birth histories collected in the 1988 surveys.

12. Since women over 49 were not included in the survey in 1988, ages in 1984 are truncated at 45.

TABLE 3: *AGE-SPECIFIC NUMBER OF CHILDREN EVER BORN*

1. ZIMBABWE: Reproductive and Demographic and Health Surveys

	(1)		(2)		(3)	
Survey:	*ZRHS 1984*		*ZDHS 1984*		*ZDHS 1988*	
Age 15-49	3.396	[.06]			2.953	[.05]
15-44	3.120	[.06]	2.756	[.05]	2.662	[.04]
15-19	0.303	[.03]	0.224	[.02]	0.188	[.01]
20-24	1.649	[.05]	1.469	[.05]	1.299	[.04]
25-29	3.205	[.08]	3.088	[.07]	2.894	[.06]
30-34	4.630	[.11]	4.403	[.09]	4.346	[.09]
35-39	6.219	[.15]	5.734	[.14]	5.537	[.11]
40-44	7.037	[.21]	6.715	[.19]	6.399	[.17]
45-49	7.464	[.26]	.		6.872	[.20]
Sample size	2574		3312		4201	

2. BOTSWANA: Family Health Surveys

Survey	*BFHS-1 1984*		*BFHS-2 1984*		*BFHS-2 1988*	
Age 15-49	3.054	[.05]	.		2.581	[.04]
15-44	2.809	[.05]	2.330	[.04]	2.387	[.04]
15-19	0.256	[.02]	0.204	[.01]	0.261	[.02]
20-24	1.444	[.04]	1.412	[.03]	1.166	[.03]
25-29	2.870	[.06]	2.679	[.06]	2.546	[.05]
30-34	4.164	[.09]	4.160	[.09]	3.698	[.07]
35-39	5.362	[.15]	4.737	[.14]	5.088	[.11]
40-44	6.259	[.21]	5.622	[.19]	5.425	[.18]
45-49	6.845	[.28]			5.752	[.21]
Sample size	3064		3593		4368	

Note: [Standard errors in parentheses]. First and third columns based on 1984 CPS and 1988 DHS resp. Middle column based on 1988 DHS evaluated at 1984; fertility calculated using birth history information.

lower estimates (based on the 1988 data) among women aged 15 through 19 and 35 though 39 in 1984.

There are several possible explanations for these differences. Recall that methodology differed across the two surveys and there is some evidence that young and old women were under-represented in the samples. Perhaps the most obvious candidate is recall error and, indeed, it is standard practice in demographic studies to treat this sort of difference as an indicator of recall error. (In essence, this is a key idea underlying the P/F method for adjusting retrospective fertility data with a single survey as suggested by Brass 1968).[13] But might there be some other reasons for the anomalies in the estimates of fertility based on these surveys?

The distribution of education

It has been pointed out above that during the 1980s, Zimbabwe, and to a lesser extent Botswana, enjoyed spectacular growth in the educational attainment of its youth. This growth is reflected in the fact that the *average* woman in 1988 reported one more year of schooling than her counterpart in 1984. Even in the context of the rapid social change that took place in these countries, this represents a large increase. This sub-section, attempts to determine the extent to which it reflects changes in the underlying populations rather than sampling differences.

Because education levels have increased over time in both Botswana and Zimbabwe, it is not possible to disentangle population from sample differences by comparing the education of women of the same age. Instead, to isolate the differences in education between the samples, it is important to compare the same *cohorts* of women. Table 4 summarizes education levels reported by women age 25 to 44 in 1984. The first column is based on the 1984 surveys; the second column is based on reported education of the same cohort of women in the 1988 surveys, at which time they would have been age 29 to 48. The third column reports the difference between reported schooling in the second and first survey for this cohort of women. If there are no sampling differences between the pairs of surveys then the difference should be zero.

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13. Little is known about the reliability of recall data that involves remembering dates (as in the birth histories recorded in 1988). Becker and Mahmud (1984) attempt to validate retrospective birth history data for Matlab by matching them with vital statistics. They find very few births are missed (around 5 percent) and these tend to be non-live births. There is, however, a general tendency for women to place the event too far back; for example, among women aged 30-39, the reported fertility rate for the previous four years was 4 percent lower than the actual rate (using a backward questionnaire) and 6 percent lower for women aged 40-49. This evidence would suggest that numbers in the second column of Table 3 should be higher than in the first column. Recall also that in the DHS there is some evidence that children aged 5 (born in 1983) were misclassified as born before then although this fact should not affect fertility as of 1984 (reported in 1988).

TABLE 4: EDUCATION LEVELS OF THE COHORT OF WOMEN AGE 25-44 IN 1984

1. ZIMBABWE

Survey:	*ZRHS*	*ZDHS*	*Difference ZRHS - ZDHS*
Average number of years of education	4.36	4.68	-0.32
	[0.08]	[0.08]	[0.12]
Percentage of women			
No education	22.9	21.2	-1.7
	[1.1]	[1.0]	[1.5]
Completed primary	30.0	34.0	4.0
school/more	[1.2]	[1.1]	[1.7]
Attended secondary	10.5	13.5	3.0
school	[0.8]	[0.8]	[1.2]
Completed more than	4.4	6.6	2.2
Form 2	[0.6]	[0.6]	[0.8]

2. BOTSWANA

Survey:	*BFHS1*	*BFHS2*	*Difference BFHS2-BFHS1*
Average number of years of education	3.53	4.02	0.49
	[0.06]	[0.05]	[0.13]
Percentage of women			
No education	37.3	36.5	-0.8
	[1.2]	[1.1]	[1.7]
Completed primary	27.1	30.2	3.1
school/more	[1.1]	[1.0]	[1.6]
Attended secondary	10.5	15.3	4.8
school	[0.8]	[0.8]	[1.2]
Completed more than	1.8	6.6	4.8
Form 3	[0.3]	[0.6]	[0.7]

Note: Standard errors in parentheses.

In both surveys, each woman reports the level of schooling (primary, secondary and tertiary) she attained as well as the specific grade completed (or passed) within that level. These data have been converted to years of education and average attainment is presented in the first row of each panel. The fraction of women who completed particular levels is reported in the rest of each panel.[14]

On average, the same cohort of women in the DHS reports more years of schooling than those in the CPS. This difference is one-third of a year in Zimbabwe and half a year in Botswana and, in both cases, this difference is significant. In Botswana, for example, the t-statistic on the difference is 3.8.

Where, within the education distribution, are these differences concentrated? Examining the grouped data in the remaining rows of Table 4, slightly fewer women report no schooling in the DHS than in the CPS. But this discrepancy is not significant. However, the probability that a woman reports herself as having completed primary school is significantly greater in the DHS. Similarly, a significantly higher proportion of DHS women report having attended secondary school. (The t-statistics on the differences are 4.0 in Botswana and 2.5 in Zimbabwe.) This inference also carries through to the proportions reporting completion of Form 3 in Botswana and Form 2 in Zimbabwe.[15]

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14. A very small fraction of women reported they had attended primary school but could not recall the exact grade; we assume they have not completed primary schooling and, when calculating years of schooling, assume they completed three at the primary level. Since less than 1 percent of women failed to report an exact grade, the effect of varying this assumption on our estimates is trivial. An assumption also has to be made about the years of schooling completed in previous levels but because exactly the same assumptions are made in processing both the 1984 and 1988 surveys, this is unlikely to generate spurious discrepancies in education levels between the surveys. Furthermore, this concern is only likely to be important for women who complete 'O' or 'A' Level and continue to a tertiary education institution. They account for a tiny fraction of the sample. For example, in both the Zimbabwe CPS and DHS, only about 1.5% of all women report more than Form 4 schooling (when 'O' Level examinations are often written). Obviously, data processing differences of one year or even two in these women's education levels will not have any substantial impact on the average for the whole sample. Furthermore, inferences based on levels of schooling, rather than years, will be unaffected by these assumptions. The 1984 survey asks about highest grade completed whereas the 1988 survey ask about highest grade passed. The bulk of the population does not complete primary school: for them there are no formal examinations that need to be passed in order to progress to the next grade. We thus view the differences in questions as being largely one of semantics for most of the population. The distinction between passing and completing is relevant only in the case of public examinations, such as 'O' Level and 'A' Level, which are taken toward the end of secondary school. The estimates of sample completion rates in Table 4 are for levels below 'O' Level.

15. For Zimbabwe, these estimates can be compared with the distribution of education of the same cohorts of women as recorded in the 1987 Intercensal Demographic Survey (ICDS). Relative to this (large) sample, 5-year cohorts of women aged 25 through 49 as of 1984 uniformly report around a fifth of a year less schooling on average in the ZRHS and the difference for this age group is significant. Of course, women under 25 are also better educated in the 1987 survey: for

In sum, women in the 1988 surveys report significantly more education than those women of exactly the same cohort in the 1984 surveys in both Botswana and Zimbabwe. A good part of the higher average number of years of education in the 1988 survey reflects a shift in the education distribution from primary to secondary school. Whether this is because the women in the 1988 survey were better educated than those in 1984 or whether they simply *reported* themselves as being better educated, we cannot tell.[16] What one can say, however, is that simple comparisons of aggregates based on these data may be quite misleading. Indeed, given the fact that education and fertility tend to be negatively correlated (see below), this suggests that it would be prudent to evaluate the evidence regarding dramatic decline in fertility in both countries with this caveat in mind.

Impact of shift in distribution of education on fertility decline

Recall that, according to the CPS and DHS, among women age 15 to 49, between 1984 and 1988, the number of children ever born declined from 3.40 to 2.95 in Zimbabwe and from 3.05 to 2.58 in Botswana. How much of this observed decline can be attributed to sampling differences in the survey? This question can be answered by exploiting the micro-data in the surveys to calculate predicted fertility rates while holding the underlying distribution of education for the population constant. These estimates are reported in Table 5.

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example, women aged 15-19 report almost a year more schooling in 1987. Young women in the 1988 ZDHS report significantly more schooling than those in the 1987 survey: women aged 15-19 (in 1988) report a half year more schooling in the 1988 survey. This difference is also significant and seems like a very large number for a single year suggesting that perhaps it reflects differences in the samples and not just additional schooling. For women aged 25 through 49, in 1988, educational attainment reported in the 1987 and 1988 surveys are virtually identical (at about 4.8 years of schooling); it differs by about .04 years which is half the standard error on the difference (0.08). For these older women, the 1987 ICDS and 1988 ZDHS education distributions are consistent although this does not imply that they are necessarily correct.

16. A National Literacy Programme (NLP) was established in the late 1970s in Botswana. A 1987 evaluation of the programme indicated it was very successful with 81 percent of those tested attaining literacy levels associated with Standard 4. (UNICEF, 1989). Since the questions in the BFHS asked about the highest grade passed (BFHS-1) or completed (BFHS-2) at school, it is unclear that the NLP should have any impact on reported years of completed schooling in the surveys. Nevertheless, there is evidence for both cohorts of women of a shift from reporting 1 to 3 years of schooling to reporting 4 to 5 years of schooling. However, for our purposes, the key shifts in the education distribution are in secondary schooling and the NLP cannot possibly explain that fact. Furthermore, recall that, on average, half a year more of schooling is reported by Batswana women surveyed in BFHS-2 compared with those in BFHS-1. In BFHS-1, half the women age 25 to 44 were literate in 1984; thus, to account for the differences in education, every single one of the other half would have had to participate in the literacy program between 1984 and 1988 *and* would have had to report themselves as having completed an extra year of schooling. This implies that by 1988, among women age 25 to 44, illiteracy would have been *wiped out* in Botswana.

TABLE 5: *FERTILITY RATES HOLDING EDUCATION DISTRIBUTION CONSTANT*

Age Cohort:	*25-34*				*35-44*			
1. ZIMBABWE								
Fertility rate based on survey dated:	*(1)* *1984*	*(2)* *1988*	*(3)* *Diff*	*(4)* *% unexpl*	*(1)* *1984*	*(2)* *1988*	*(3)* *Diff*	*(4)* *% unexpl*
Education distribution:								
As reported	3.85	3.57	0.28	.	6.58	5.89	0.69	.
Based on 1984 survey	3.85	3.62	0.23	20	6.58	5.96	0.62	10
Based on 1988 survey	3.70	3.57	0.13	52	6.49	5.89	0.60	14
Based on 1987 ICDS	3.73	3.55	0.18	36	6.46	5.89	0.60	14
2. BOTSWANA								
Fertility rate based on survey dated:	*(1)* *1984*	*(2)* *1988*	*(3)* *Diff*	*(4)* *% unexpl*	*(1)* *1984*	*(2)* *1988*	*(3)* *Diff*	*(4)* *% unexpl*
Education distribution:								
As reported	3.43	3.07	0.35	.	5.76	5.17	0.59	.
Based on 1984 survey	3.43	3.10	0.33	7	5.76	5.33	0.43	27
Based on 1988 survey	3.42	3.07	0.35	0	5.64	5.17	0.47	20

Note: % unexpl is percentage of observed fertility decline that is left unexplained when the education distribution is held constant.

The first row presents the average number of children ever born as reported by women of the same age in the 1984 survey (in column 1) and in the 1988 survey (in column 2). The differences, in column 3, is the observed fertility decline for this age group of women. In Zimbabwe, the decline is seven-tenths of a child for women age 35 to 44.[17]

Appendix Table 1 reports the number of children ever born to women, stratifying on both age and education. With these fertility rates, one can calculate the average number of children ever born to women as reported in each survey, using the distribution of education for each cohort implied by the 1984 and 1988 surveys.

17. Without an education history, it is necessary to restrict attention to women who would have completed their education by 1984 (and who are also followed in 1988): thus, the evidence is examined for women age 25 to 44, stratified into two ten year age groups.

To illustrate the procedure, consider women age 25-34. The education specific fertility rates based on the 1984 survey (Appendix Table 1) are multiplied by the education distribution in that survey. The sum of these products, which is reported fertility for these women, is displayed in row 2, column 1 of Table 5. Next, take the education distribution for women age 21-30 in 1984 (who would have been 25-34 in 1988) and multiply those numbers by reported education specific fertility rates as reported by 25-34 year old women in the 1988 survey. The sum of those products is an estimate of the fertility this cohort of women would have reported in 1988 had the education distribution remained constant across the two surveys (at the level reported in the 1984 survey while adjusting for the fact that women in different cohorts are being compared). This number is displayed in row 2, column 2 of Table 5. The difference between these numbers is an estimate of fertility decline for this cohort of women, holding the education distribution constant. Comparing this estimate with the decline as reported in the two surveys (row 1, column 3) tells us how much of that reported decline can be explained by the change in the education level of the same cohort of women across the two surveys. This is the percentage reported in column 4; if none of the observed decline can be attributed to changing sample composition, then this proportion should be zero. The same exercise is repeated using the education distribution in the 1988 survey (row 3) and, for Zimbabwe, the 1987 Intercensal Demographic Survey (row 4).[18]

In Zimbabwe, among women aged 25-34, *over half* the observed decline in fertility across the two surveys can be attributed to differences in the distribution of education of this cohort assuming the distributions implied by the 1988 survey; 20 percent remains unaccounted for when the 1984 distribution is adopted and 37 percent given the 1987 distribution. Among women aged 35 to 44, between 10 and 14 percent of the observed decline is due to the shift in the distribution of schooling. In Botswana, the observed decline in fertility for 25 to 34 year old women is robust to changing the education distribution. Among older women (35-44), however, between 20 and 27 percent of the observed fertility decline can be attributed to the sample composition.

There is no doubt that there has been a decline in fertility in both Zimbabwe and Botswana. What is in doubt, however, is the rate of decline. Estimates based on aggregate data may be too high as they can, in part, be explained by the fact that relative to the 1984 survey, the 1988 survey gathered information from women who are, or report themselves as being, better educated. Without knowledge of the shape of the true distribution of education at each survey date, it is very hard to determine the magnitude (and significance) of fertility change in either country.

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18. It is important to note that tests of differences in the education distribution must be based on comparing women of the *same cohort* in the two surveys. To assess the impact of these differences on fertility decline,women in the *same age group* must be compared. If the samples are identical, then a comparison of reported fertility of women (as of 1984) for the same cohort of women could provide information about respondent recall error. This issue is taken up below.

Reasons for the shift in the distribution of education

There are several reasons why one might observe increases in reported education for the same cohort of women across each pair of surveys, even in the absence of a change in actual educational attainment. First, women may mis-report their age: in order for cohort-specific education rates to rise in a context of increasing education over time, younger women would have to report themselves as being *older* than their actual age. Furthermore, in order to affect comparisons of the pairs of data sources, the propensity to over-report one's age would also have to be *increasing* over time. Finally, this study pointed out above that the age distributions in the pairs of surveys seem to be consistent with each other although it does appear that young and old women were mis-classified so that they were excluded from the survey; this should not have affected the women in the 25 to 40 age range — the women on whom we have focussed. Age mis-reporting therefore seems like an unlikely candidate to explain the observed differences in education.

As women get older, however, they may simply report themselves as being better educated. Once again, in order for this to explain the preceding results, this propensity to mis-report would have to be an increasing function of time. That does not seem too unreasonable in a society with dramatically rising educational attainment as older women may seek to conform more closely to the average for the country. It has been remarked earlier that in Zimbabwe, where there is an additional source of information on education by cohort, there is very little difference between cohort specific reported education in the 1988 DHS and the 1987 Intercensal Demographic Survey.

But what is the evidence in other countries? Unfortunately, as far as the authors are aware, there are no nation-wide regularly repeated cross-section data sources available for any African country and so they rely on data from Taiwan and the United States. The Current Population Survey is collected annually in the United States; using the March waves from 1980 through 1990, the authors have calculated the reported years of education for white men and women born in the year 1940 and in 1945; they are displayed in Figure 1. For men, there is no evidence that reported education has risen for these cohorts and for women there is some tendency towards upward drift although the biggest gap is only about a 3 percent increase in reported schooling which is not close to the magnitude of the change observed in Botswana or Zimbabwe.[19]

Perhaps in a society that is changing more rapidly, regression towards the mean will be more apparent. Figure 2 presents reported education for women in Taiwan using a similar data source, the Personal Survey of Income Distribution, for the same period. Sample sizes are smaller than in the US data and so we examine women born between 1940 and 1944 in addition to the 1945 to 1949 cohort. There is no evidence

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19. The cell sizes lie between 700 and 1100 and the standard errors are all very close to 0.1. In a bivariate regression of education on time, the slope is zero for both cohorts of men; for women, the estimated drift is 0.03 years of schooling in each survey year.

Figure 1
Mean years of reported education of males and females in United States
Current Population Surveys, March 1980 - March 1990

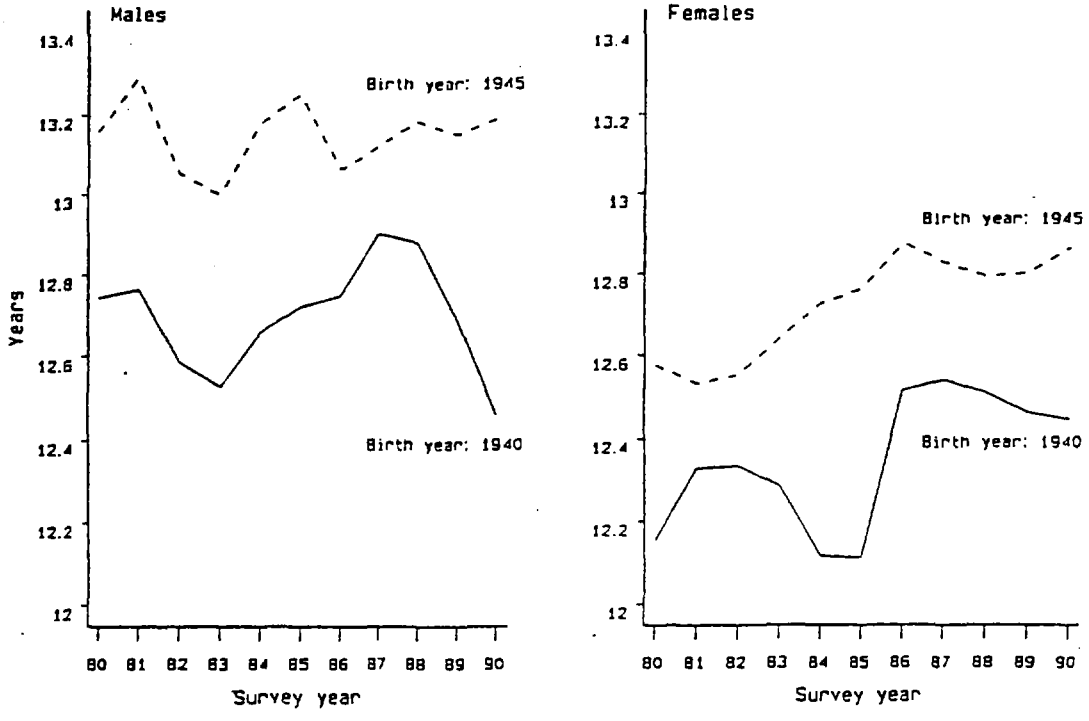
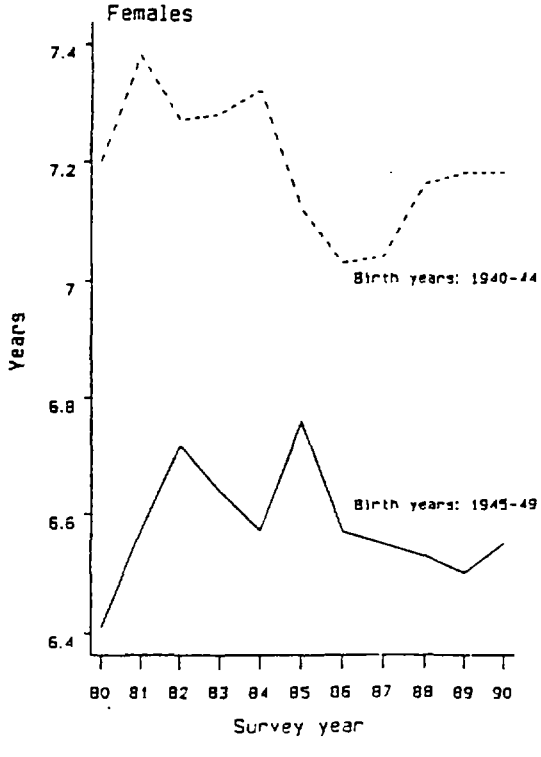


Figure 2
Mean years of education of females in Taiwan
Personal Survey of Income Distribution, 1980 - 1990



of consistent upward drift in reported education in these data; if anything the trend appears to be downward.[20] In the US and Taiwanese data, there does not appear to be a general tendency for reported education to rise with age, at least to the extent observed in the Botswana and Zimbabwe data.

We turn next to data from Kenya where demographers have argued there is some evidence for dramatic decline in fertility. As in Botswana and Zimbabwe, a CPS and DHS were conducted in 1984 and 1988 respectively but, as noted by Blacker (1994), there may be reasons to be skeptical that these surveys are directly comparable. Based on estimated parities, he concludes the Kenyan CPS is an outlier and should be rejected. He does not, however, compare the distributions of education of women in the two surveys.

It turns out that women of the same cohort tend to be better educated in the Kenyan DHS relative to the CPS. For example, among those aged 25 to 34 in 1984, the average woman reported completing 3.7 years of schooling in the CPS but 4.5 years in the 1988 DHS; for the 35 to 44 age group, reported years of education was 2.0 and 2.5 respectively. As in Botswana and Zimbabwe, the differences tend to be concentrated among the better educated: for example, in the 25 to 34 year group, 15 percent report completing Form 2 or more in 1984 but in 1988 this proportion is 20 percent. Once again part, but not all, of the difference in fertility decline can be attributed to these sampling differences. Apparently, the Botswana and Zimbabwe cases are not unique.

Rather than changes in reporting behavior by women, it may be that the differences in the surveys reflect changes in the underlying population. It seems unlikely that mortality alone could explain all the differences: not only would this imply extremely high mortality rates but also differentials between the least educated and better educated for which there is no evidence. Net migration abroad is also far too small to account for the observed differences.

Alternatively, there may be shifts in the population that are not adequately captured by the sampling scheme. In both Botswana and Zimbabwe, the sampling frames of the CPS and DHS are based on the 1981 and 1982 Censuses, respectively. If, as the frame ages, the more mobile are less likely to be included in the samples, then given the overwhelming evidence that the better educated are more mobile, one would expect education of the same cohort to be lower in the second survey. Yet exactly the opposite is seen. Furthermore, net migration tends to be out of the rural sector into urban areas and so the education differentials should be negative in the rural areas but positive in the urban areas. There is no evidence that this is true, either in Botswana or Zimbabwe. For example, among women in Zimbabwe aged 25 to 34 in 1984, reported education of the average urban woman in the earlier survey was 6.3 years and 7.1 in the later survey; among rural woman, reported education was 3.2 and

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20. The authors are grateful to Chris Paxson who calculated the numbers underlying the figure. For a description of the data see Deaton and Paxson (1993) and Republic of China (1989). It is possible that the downward trend reflects in-migration of women from the mainland.

4.2 years in the two surveys. The lower levels of cohort specific fertility, as of 1984, in the later survey also persist in both the rural and urban sectors. Stratification on region leads to the same conclusion in terms of both education and fertility.[21]

In order to update the Census based sampling frame, for all four surveys a new listing of households was drawn up in each cluster and then households were randomly drawn from those listings. One possible explanation for the education differentials across the pairs of surveys might be that the drawing was not random, or that the listings were not complete, with better constructed dwellings (where the better educated live) being more likely to be included in the samples.[22] If this is a widespread problem, then as frames are updated, there should be discrete changes in the underlying population. Furthermore, the education drift should be common across cohorts. Figures 1 and 2 provide no evidence for this in either Taiwan or the United States: in fact, in each figure the education changes for the pairs of cohorts tend to be inversely correlated with one another. Unfortunately, one cannot determine whether an explanation along these lines can explain the differences between the pairs of surveys in Botswana and Zimbabwe.

Apparently, there is no simple explanation for the differences in the sample characteristics across the pairs of surveys in Botswana and Zimbabwe. The study does find, however, a similar pattern in the Kenyan CPS and DHS — but not in national samples for the United States or Taiwan. Explaining these differences is an important and complex issue, especially in the context of rapidly changing socio-economic environments.

Changes in the determinants of fertility outcomes

The study has argued that comparing *levels* of fertility outcomes in the 1984 and 1988 surveys is not straightforward. Furthermore, indirect methods that fail to take into account the differences in the sample compositions may lead to misleading inferences regarding the dynamics of fertility change in Botswana and Zimbabwe.

Demographers are also interested in the *determinants* of fertility outcomes and, in particular, the relationship between education and the number of children ever born to a women. If differences across the pairs of surveys do not reflect changes in reporting behavior, but rather sample composition differences, then it should be possible to trace out changes in the effects of education on fertility during the 1980s. This is because sample composition differences should not bias estimated education

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21. Among women aged 25 to 34 in 1984, in Mashonaland their average reported education was 3.9 years in 1984 and 4.4 years in 1988; in Matabeleland, the difference is larger (3.4 to 4.7) and in the rest of Zimbabwe it is smaller (5.3 to 5.7). It would be imprudent to make much of these inter-regional differences since they are based on small samples and the standard errors are quite large, being around 0.4 for Matabeleland and 0.15 for the other two regions.

22. Experience from other surveys suggests there is some evidence that when enumerators "randomly" pick households in a community, they are least likely to visit the poorest.

effects and so it may be reasonable to assume that will be comparable across the surveys at least within cohorts.

Next, this assumption is examined in order to delve a little more deeply into potential sources of differences between the pairs of surveys. Fertility estimates for women in 1984 based on the birth histories recorded in 1988 are reported in the middle columns of each group in the second panel of Appendix Table 1. These are exactly the same estimates as presented in Table 3 except now they are stratified on both age and education.

One might expect that as women recall beyond the last five years, their memories dim and they fail to enumerate all the births. Estimates of fertility should, therefore, be lower in the middle column (recall for the period prior to 1984 but reported in 1988) than the first column (recalled in 1984). The patterns in Zimbabwe are quite intriguing. Consider first women aged 25 through 34. Those at the bottom of the education distribution certainly do report fewer births.[23] But women who have at least completed primary schooling report *more* births.[24] A remarkably similar pattern emerges for older women: those with no education report one child less on average (a significant difference) and it is only women who have more than Form 2 schooling that report more births. Why would better educated women systematically report more births in the 1988 survey?[25]

We can only speculate on this question. It may be that better educated women tend to place events further back than those with little education. This seems unlikely and the evidence in Becker and Mahmud's (1984) Bangladesh validation study suggests no relationship between education and extent of back-casting.

A more likely candidate, perhaps, lies in differences in the survey design: in the second survey women were asked to complete an entire birth history, whereas in the first survey they reported only the number of children born (alive and dead, by gender). It may be that the birth histories prompted better educated women to recall more events or they may have reported children born after 1984 as being born before then.[26] On the other hand, it may be that less educated women failed to recall details

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23. For women with some primary education this difference is significant.

24. Women who have completed Form 2 remember a *significantly* larger number of births prior to 1984 in the second survey relative to the women interviewed in the first survey.

25. The fact that respondent recall error is related to education means that comparisons of fertility as of 1984 based on the 1984 and 1988 surveys will confound respondent error and changes in sample composition.

26. There is evidence that women (or enumerators) tended to classify children aged 5 at the time of the survey as being older (presumably to avoid having to complete the child module of the survey). It is not clear why better educated women would have reported children who were aged more than 4 in 1988 as being younger than that.

TABLE 6: *DETERMINANTS OF NUMBER OF CHILDREN EVER BORN*

1. ZIMBABWE

Age group	*15-24*			*25-34*			*35-44*		
Survey	*ZRHS*	*ZDHS*	*ZDHS*	*ZRHS*	*ZDHS*	*ZDHS*	*ZRHS*	*ZDHS*	*ZDHS*
Date	*1984*	*1984*	*1988*	*1984*	*1984*	*1988*	*1984*	*1984*	*1988*
Maternal education:									
Pre-school	0.043	-0.295	0.130	0.450	-0.451	-0.390	0.096	0.741	0.256
	[0.35]	[2.58]	[1.02]	[1.61]	[2.00]	[1.83]	[0.22]	[1.93]	[0.71]
Some primary	-0.153	-0.308	-0.297	-0.249	-0.342	-0.464	-0.393	0.526	0.147
	[1.62]	[4.11]	[3.51]	[1.45]	[2.31]	[3.39]	[1.37]	[1.89]	[0.60]
Completed primary	-0.224	-0.418	-0.527	-0.455	-0.460	-0.646	-0.881	-0.065	-0.237
	[2.22]	[5.30]	[6.26]	[2.32]	[2.84]	[4.40]	[2.33]	[0.17]	[0.80]
Form 2	-0.306	-0.688	-0.652	-1.015	-0.573	-0.807	-0.881	-0.754	-0.517
	[2.85]	[7.97]	[7.67]	[3.66]	[2.58]	[3.99]	[1.21]	[1.28]	[1.21]
> Form 2	-0.681	-0.866	-1.081	-1.851	-1.806	-1.707	-3.106	-0.818	-1.818
	[6.04]	[11.05]	[12.95]	[5.62]	[7.67]	[8.84]	[4.61]	[1.45]	[3.96]
# obs	1071	1584	1861	862	1096	1268	486	632	782
R-squared	0.49	0.47	0.51	0.26	0.23	0.29	0.15	0.10	0.11
F(educ)	11.1	31.3	71.4	9.8	12.1	16.2	5.0	2.7	4.4
F(all covs)	128.1	175.0	244.4	37.2	41.6	65.6	10.6	8.6	12.3

2. BOTSWANA

Age group	*15-24*			*25-34*			*35-44*		
Survey	*BFHS1*	*BFHS2*	*BFHS2*	*BFHS1*	*BFHS2*	*BFHS2*	*BFHS1*	*BFHS2*	*BFHS2*
Date	*1984*	*1984*	*1988*	*1984*	*1984*	*1988*	*1984*	*1984*	*1988*
Maternal education:									
Pre-school	-0.127	0.048	-0.237	0.247	0.362	0.364	0.771	-0.005	-0.372
	[0.85]	[0.34]	[1.54]	[1.07]	[1.75]	[1.69]	[2.31]	[0.02]	[1.17]
Some primary	-0.198	-0.036	0.057	0.132	0.186	0.178	0.216	0.184	0.001
	[2.80]	[0.64]	[0.92]	[0.97]	[1.47]	[1.59]	[0.74]	[0.69]	[0.01]
Completed primary	-0.142	-0.211	-0.127	-0.131	-0.304	-0.308	-0.627	-0.171	-0.521
	[2.36]	[4.33]	[2.29]	[0.94]	[2.34]	[2.93]	[1.34]	[0.36]	[1.83]
Form 1-3	-0.390	-0.296	-0.261	-0.899	-0.703	-0.826	-0.757	-0.576	-0.869
	[5.74]	[5.78]	[4.61]	[5.16]	[4.30]	[6.85]	[1.16]	[1.09]	[2.08]
> Form 3	-0.689	-0.682	-0.704	-1.209	-1.445	-1.438	-0.769	-1.955	-2.000
	[5.58]	[9.72]	[8.46]	[3.41]	[7.22]	[8.94]	[0.68]	[4.02]	[5.24]
# obs	1337	1881	1895	1023	1178	1524	553	534	728
R-squared	0.45	0.49	0.41	0.22	0.27	0.25	0.06	0.08	0.09
F(all educ)	10.8	24.3	24.3	9.2	17.4	28.9	2.3	4.1	6.7
F(all covs)	135.0	228.9	162.2	35.3	55.3	62.3	4.5	5.4	8.7

Note: See Table 3. [t statistics] in parentheses. F() is F statistic for joint significance. Regressions include controls for mother's age and location.

on every live birth and so revised their number of children ever born downwards. Without more evidence, we cannot distinguish these hypotheses.

In order to understand the implications of these differences for inferences regarding the changing effects of education on fertility in Southern Africa, Table 6 presents the data slightly differently. The estimated effect on the number or children ever born to a woman of her highest level of educational attainment is reported for each age cohort (controlling for age and whether the woman lives in an urban area). The first column of each panel is based on the 1984 survey data, the third column on the 1988 data and the middle column is based on the 1988 survey back cast to reflect age, fertility and education as of 1984.

If the only differences between the pairs of surveys are due to sample composition, then the estimated education effects in the first two columns of each panel should be the same. They are not. Generally speaking, for all age groups and both surveys, fertility and education tend to be negatively correlated but the magnitude and significance of this correlation varies dramatically between the surveys. For example, taking women aged 35 to 44, according to the 1984 survey, the fertility of women who have completed primary school or more is significantly lower than women with no schooling. By 1988, this difference is significant only for women with at least Form 2 education. Furthermore, the effect of education on fertility has apparently been considerably reduced during these four years.[27]

Comparing these estimates with those based on the ZDHS dated as of 1984 suggests that both of these inferences may be wrong. According to these data, women with at least Form 2 schooling had no fewer births than those with no schooling in 1984 but by 1988 there was a dramatic increase in the impact of education. Furthermore, based on the 1988 data, in 1984 women with less then seven years of schooling (had not completed primary school) had borne significantly *more* children than women of the same cohort with no education. Thus, comparing the second and third columns, we might infer that the impact of education on reducing fertility has actually increased during the four years between the two surveys.

In Botswana, the patterns are broadly similar, although perhaps not quite as stark. Returning to Appendix Table 1, women at the bottom of the education distribution tend to recall fewer births[28] and the better educated are inclined to recall more births (prior to 1984) in the second survey. The 7 *per cent* of women at the top of the education distribution (greater than Form 3) are an anomaly as they report far fewer children born prior to 1988 than in 1984; indeed, women aged 35 to 44 in the second survey report one fewer children born by the first survey date. The same point is abundantly clear in Table 6. Consider women aged 35-44 with at least Form 3

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27. For example, women with at least Form 2 education had 3.1 children fewer than women with no education in 1984 but only 1.8 children fewer in 1988.

28. Apart from those with pre-school education in the 25 to 34 age group although this difference is certainly not significant.

schooling: comparing the 1984 and 1988 estimates, the impact of schooling on reducing fertility has risen dramatically; comparing the estimates based on BFHS-2 in 1988 and 1984, all of this observed change appears to be due to sample differences.

The evidence indicates that not only might comparisons of levels of fertility outcomes based on the 1984 and 1988 data be misleading but also that comparisons of their determinants are also complicated by differences between the pairs of surveys. It also suggests that these differences do not reflect solely sample composition but that there is additional (unobserved) heterogeneity. Understanding the extent to which the levels and correlates of fertility have changed in Botswana and Zimbabwe is not so straightforward.

5. CONCLUSIONS

For many countries, the Contraceptive Prevalence and Demographic Health Surveys are among the first nation-wide demographic and socio-economic surveys made available for research at the primary level. There can be little doubt that the CPS and DHS, in general, have made important contributions to the understanding of demographic processes in developing countries. In Botswana and Zimbabwe, it has only been with the collection and release of these high quality surveys that analysts have been able to examine the evidence regarding fertility decline in both countries.

It is clear that there have been fertility declines in both Botswana and Zimbabwe during the mid-1980s. What is less clear, however, is the magnitude of those declines. Comparisons of aggregate fertility estimates based on the 1984 CPS and 1988 DHS data appear to have resulted in over-estimation of the rate of decline since it can, in part, be attributed to differences in sample composition and survey methodology. Apparently, the evidence for dramatic reductions in fertility during the mid-eighties in Botswana and Zimbabwe is not as strong as has been previously claimed and so population projections based on these estimates will probably turn out to be too low when results from the latest Censuses are released.

In particular, the evidence presented in this paper indicates that, relative to the 1984 CPS, women of the same cohort in the 1988 DHS tend to be better educated. For example, Batswana women age 25 to 44 in the 1984 survey report themselves as having completed half a year less schooling than the same cohort of women in 1988. The difference is significant in both Botswana and Zimbabwe and the evidence suggests that it reflects sampling differences between the CPS and DHS.

This fact has important implications for the conventional wisdom regarding the rate of demographic change in both countries. Among women aged 25 to 34 in Zimbabwe in 1984, between 20 and 50 percent of the observed fertility decline can be attributed to differences in education across the surveys; between 20 and 30 percent of the decline among women aged 35 to 44 in Botswana can similarly be explained. For the other cohorts, the discrepancies between the surveys are smaller. Since education is positively correlated with contraceptive prevalence, simple comparisons of aggregate data from the pairs of surveys is likely to over-estimate increases in prevalence. Thus, the argument, which some have made, that fertility *must* have declined dramatically *because* contraceptive prevalence rose dramatically is far from convincing. Similarly, part of the observed increases in child survival might also be attributed to differences in the surveys although this comparison is complicated by differences in both the manner questions were posed in the surveys and also the education levels of women in the two samples.

In general, it is not obvious that inferences on the magnitude of the time series trend in demographic outcomes in Botswana and Zimbabwe should be based solely on the CPS and DHS data. As the final reports of both the 1988 BFHS-II and ZDHS recommend, prudence is needed in interpreting these data. It is likely that it will only be with the release of more socio-demographic data at the primary level that researchers and policy makers can hope to understand the complex process of social change taking place in Southern Africa.

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APPENDIX TABLE 1: *REPORTED NUMBER OF CHILDREN EVER BORN*

Age Cohort:	*15-24*			*25-34*			*35-44*		
1. ZIMBABWE									
Survey:	*ZRHS*	*ZDHS*	*ZDHS*	*ZRHS*	*ZDHS*	*ZDHS*	*ZRHS*	*ZDHS*	*ZDHS*
Date:	*1984*	*1984*	*1988*	*1984*	*1984*	*1988*	*1984*	*1984*	*1988*
None	1.78	1.59	1.65	4.34	4.19	4.29	7.11	6.08	6.24
	[0.15]	[0.11]	[0.15]	[0.20]	[0.15]	[0.14]	[0.27]	[0.23]	[0.21]
Pre-school	1.49	1.23	1.81	4.51	3.77	3.84	7.10	6.87	6.41
	[0.17]	[0.14]	[0.20]	[0.29]	[0.22]	[0.23]	[0.46]	[0.35]	[0.32]
Some primary	1.04	1.18	1.10	4.06	3.89	3.74	6.60	6.57	6.19
	[0.06]	[0.06]	[0.06]	[0.11]	[0.10]	[0.09]	[0.18]	[0.18]	[0.16]
Completed primary	1.20	0.98	0.62	3.45	3.54	3.57	6.00	5.60	5.57
	[0.07]	[0.07]	[0.05]	[0.13]	[0.10]	[0.10]	[0.28]	[0.27]	[0.19]
Form 2	0.58	0.39	0.45	2.87	3.37	3.25	5.31	4.46	4.87
	[0.07]	[0.05]	[0.04]	[0.18]	[0.19]	[0.17]	[0.61]	[0.39]	[0.32]
> Form 2	0.40	0.17	0.38	1.80	1.85	1.96	3.06	4.45	3.71
	[0.05]	[0.02]	[0.03]	[0.18]	[0.13]	[0.12]	[0.37]	[0.46]	[0.39]
2. BOTSWANA									
Survey:	*BFHS1*	*BFHS2*	*BFHS2*	*BFHS1*	*BFHS2*	*BFHS2*	*BFHS1*	*BFHS2*	*BFHS2*
Date:	*1984*	*1984*	*1988*	*1984*	*1984*	*1988*	*1984*	*1984*	*1988*
None	1.31	1.27	1.16	3.57	3.49	3.43	5.72	5.36	5.57
	[0.09]	[0.07]	[0.09]	[0.12]	[0.11]	[0.10]	[0.25]	[0.24]	[0.19]
Pre-school	1.09	1.34	0.49	4.07	4.17	4.00	6.51	5.28	5.23
	[0.25]	[0.21]	[0.18]	[0.31]	[0.25]	[0.27]	[0.31]	[0.39]	[0.37]
Some primary	0.91	0.99	0.88	3.81	3.78	3.54	5.85	5.40	5.56
	[0.07]	[0.06]	[0.06]	[0.12]	[0.11]	[0.10]	[0.20]	[0.17]	[0.16]
Complete primary	0.88	0.71	0.69	3.30	3.12	2.87	4.74	4.87	4.87
	[0.05]	[0.04]	[0.03]	[0.08]	[0.11]	[0.07]	[0.32]	[0.41]	[0.24]
Form 3	0.51	0.52	0.54	2.39	2.53	2.31	4.49	4.63	4.50
	[0.04]	[0.03]	[0.03]	[0.10]	[0.11]	[0.08]	[0.34]	[0.33]	[0.25]
> Form 3	0.52	0.32	0.49	2.13	1.89	1.79	4.34	3.06	3.33
	[0.08]	[0.04]	[0.05]	[0.15]	[0.12]	[0.08]	[0.61]	[0.18]	[0.18]

Note: [Standard errors in parentheses]. First and third columns based on 1984 CPS and 1988 DHS resp. Middle column based on 1988 DHS evaluated at 1984; fertility calculated using birth history information.

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