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The Polygyny–Fertility Hypothesis: a Re-evaluation*

L. L. BEAN† AND G. P. MINEAU†

INTRODUCTION

In societies in which fertility within marriages is not limited, variations in age at marriage and proportions married often account for much of the observed differences in fertility levels. Fertility patterns may also be strongly influenced by biological factors such as lactation and sterility, or by marital patterns such as levels of family stability, the prevalence of consensual unions, serial monogamy and multiple marriages. The continuing high levels of polygyny among a variety of African societies, perhaps as much as 30 per cent of all married women in Kenya according to World Fertility Survey data,[1] have resulted in a considerable body of literature on the relationship between polygyny and fertility.[2] This research has produced what has generally been recognized as the polygyny–fertility hypothesis.

Specifically, the polygyny–fertility hypothesis suggests that the fertility of women in polygynous marriages is lower than that of women in monogamous marriages. Research related to this hypothesis, however, does not provide uniform results. In a number of studies the validity of the hypothesis has been questioned.[3] Failure to provide supporting evidence, however, may stem largely from inadequacies of the data and incomplete analysis. Many of the studies of polygyny and fertility are based upon limited ethnographic and demographic surveys conducted largely in African societies in which polygyny is most prevalent.[4] The samples in these studies are often small, so it is not

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[1] W. Henry Mosley, Linda H. Werner and Stan Buker, 'The Dynamics of Birth Spacing and Marital Fertility in Kenya', World Fertility Survey, *Scientific Reports*, No. 30, August, 1982. Caldwell reports half of all Yoruba women were in polygynous marriages in 1973. J. C. Caldwell, 'The economic rationality of high fertility: an investigation illustrated with Nigerian survey daya', *Population Studies*, **31** (1977), pp. 5–28.

[2] Vernon R. Dorjahn, 'The factor of polygyny in African demography', in W. Bascom and M. H. Herskovits (eds.), *Continuity and Change in African Cultures* (Chicago: University of Chicago Press, 1959); H. V. Muhsam, 'Fertility of Polygamous Marriages', *Population Studies*, **10** (1956), pp. 3–16; Alfred O. Ukaegbu, 'Fertility of women in polygynous unions in rural Eastern Nigeria', *Journal of Marriage and the Family*, **39** (1977), pp. 397–404.

[3] P. O. Ohadike, 'A demographic note on marriage, family and family growth in Lagos, Nigeria', in J. Caldwell and C. Okonjo (eds.), *The Population of Tropical Africa* (London: Longman, Green and Co., 1968), pp. 379–392; P. O. Olusanya, 'The problem of multiple causation in population analysis, with particular reference to the polygamy–fertility hypothesis', *The Sociological Review*, **19** (1971), pp. 165–178; I. Sembajwe, 'Effect of age at first marriage, number of wives, and type of marital union on fertility', *Journal of Biosocial Science*, **11** (1979), pp. 341–351; Alfred O. Ukaegbu, 'Marriage habits and fertility of women in tropical Africa: a sociocultural perspective', in J. Dupâquier, E. Helin, *et al.* (eds.), *Marriage and Remarriage in Populations of the Past* (New York: Academic Press, 1981), pp. 127–137.

[4] Charles E. Welch and Paul C. Glick, 'The incidence of polygamy in contemporary Africa: a research note', *Journal of Marriage and Family*, **43** (1981), pp. 191–193.

possible to provide detailed cross classifications which would make it possible to control for such confounding factors as variations in duration of marriage for each wife or numbers of wives married to each man.

Additionally, the motive for taking an additional wife or wives may stem from the inability of earlier wives to bear and/or continue to bear children. Thus, particularly in African populations with moderately high levels of secondary sterility, specification of fertility by wife-order is essential. Computing the mean fertility of all polygynous wives might result in support of the fertility–polygyny hypothesis for reasons other than those traditionally offered for reduced fertility among multiple marriages (reduced frequency of coitus per wife within multiple marriages and increasing age of the husband). Clearly the hypothesis, as traditionally specified, is theoretically incomplete.

A more logically complete specification of the relationship between polygyny and fertility would suggest that the fertility of polygynous wives relative to that of monogamous wives will vary with wife-order and duration of exposure to the risk of conception. Specifically, if sterility rates are low so that the motive for taking additional wives is not primarily the need to replace infertile first wives, and if the principle of equality among wives (as in the case of Islamic and Mormon groups) prevails, then the number of children ever born should decrease with increasing wife-order, as coital frequency would decrease with higher wife-order because of the increased number of wives within the family and the increasing age of the husband with each higher-order marriage. In addition the chance of early widowhood increases with wife-order, thus restricting the period of exposure to the risk of conception among later wives.

The presumed explanation of both the revised and the original relationship rests upon the notion that there are variations in coital frequency between monogamous and polygynous marriages and/or within polygynous marriages which produce the observed differences. Yet it is difficult to test this effect directly because any evidence would be suspect if fertility limitation within marriages were widely practised in the study population. To avoid this confounding effect, access to data on populations of natural fertility is essential.

Testing this more specific hypothesis is difficult because of problems inherent in survey research which has traditionally been employed to test the fertility–polygyny hypothesis. Most important, memory error may influence the number of children reported as ever born. Because memory error is related to age, there may be artificial variations by wife-order; at the time when multiple wives are interviewed, first wives are older than second and later wives. Also, Olusanya has shown that in contemporary Nigeria polygynous wives are more likely to be illiterate than monogamous wives.[5] Consequently, educational differences may also be related to differences in the completeness of reporting of the number of children ever born for polygynous rather than monogamous wives.

An effective test of the polygyny–fertility hypothesis, therefore, requires a body of data from a population with natural fertility, in which the fertility of monogamous and polygynous wives is accurately recorded by order of wife. Access to a body of data covering the population of Utah, during the nineteenth century, in which polygyny was widely practised and where extensive accurate family records were maintained, provides the opportunity to test our modified fertility polygyny hypothesis more exhaustively. Cultural and historical differences which may produce variations between this population and populations in contemporary Africa and traditional primitive societies are explored in the interpretation of the findings. None of the differences are such as to mitigate the value of exploring a body of data from a western, multiple-marriage population in which data on marriage, fertility, and related demographic variables are accurately recorded.

[5] Olusanya, *loc. cit.* in footnote 3. Supporting evidence is provided by Caldwell, *loc. cit.* in footnote 1.

DATA

The data used in this analysis are derived from a set of family group sheets[6] extracted from the holdings of the Genealogical Society of Utah, an organization which retains an extensive archive of genealogical and supporting reference material particularly well suited to historical demographic research.[7] Approximately 170,000 family group sheets, with one or more family member being born or dying in Utah, were selected.[8] The period covered by the data relates to male heads of families born about 1800 or later. The records employed in this project have been transferred to a computer in conjunction with a medical genetics study.[9] The value of the records for historical demographic research has been outlined by Bean *et al.*[10] and the strengths and limitations of the records for fertility research have been discussed in a series of articles.[11]

In the family group sheets used in this study the male head of the family is typically taken as the reference individual providing details for his wife and their children, as well as selected information for his and his wife's parents. Supplementary information identifies additional wives, and a computerized linkage routine developed for this project enables us to match and link family group sheets based upon husband's name and birth date for second and additional wives.

A significant part of the population of the Church of Jesus Christ of Latter-day Saints (L.D.S. or Mormon) which entered into multiple marriages during the nineteenth century is included in the data set. The phenomenon of multiple marriages in this population has been examined extensively.[12] For the purpose of this study, it is only important to indicate that the L.D.S. Church recognized the legitimacy of multiple marriages for men between 1842 and 1890.

The data used in this study include 2,534 polygynists with 7,378 marriages identified by using the following rules.[13] A man was a polygynist if he was married to at least two wives during the same period, using the date of the marriage as the beginning and the date of birth of the last child as the end point of each marriage. If no children are recorded for the union, the marriage date was also taken as the end point. This definition creates a potential problem. If the first wife has no children or childbearing ends before the man took a second wife, and if he never married a third wife, he would not have been defined

[6] The family group sheet is described in M. Skolnick, L. Bean, D. May, V. Arbon, K. De Nevers and P. Cartwright, 'Mormon demographic history. I. Nuptiality and fertility of once-married couples', *Population Studies*, **32** (1978), pp. 5–19, and represents a data summary sheet comparable to the form used by Henry and others for the compilation of historical demographic data for which the family is the unit of analysis.

[7] Lee L. Bean, Geraldine P. Mineau, Katherine A. Lynch and J. Dennis Willigan, 'The Genealogical Society of Utah as a data resource for historical demography', *Population Index*, **46**(1) (1980), pp. 6–19.

[8] The project is designed to develop an exhaustive file of the Utah population and their ancestors and collateral relatives. Therefore, the family group sheet file is being complemented with official birth and death certificates which became available in 1905, medical records, and manuscript censuses.

[9] Lee L. Bean, Dean L. May and Mark Skolnick, 'The Mormon historical demography project', *Historical Methods*, **11** (1978), pp. 45–53.

[10] Bean, *et al. loc. cit.* in footnote 7.

[11] G. P. Mineau, L. L. Bean and M. Skolnick, 'Mormon demographic history. II. The family life cycle and natural fertility', *Population Studies*, **33** (1979), pp. 429–446; J. Dennis Willigan, Geraldine P. Mineau, Douglas L. Anderton and Lee L. Bean, 'A macrosimulation approach to the investigation of natural fertility', *Demography*, **19** (1982), pp. 161–176.

[12] Stanley S. Ivins, 'Notes on Mormon polygamy', *Western Humanities Review*, **10** (1956), pp. 229–239; Larry Logue, 'Tabernacles for waiting spirits: monogamous and polygynous fertility in a Mormon town', *Journal of Family History*, **10** (1985), pp. 60–74; James E. Smith and Phillip R. Kunz, 'Polygyny and fertility in nineteenth-century America', *Population Studies*, **30** (1976), pp. 465–480.

[13] A computer search, using the definition employed in this study, generated a listing of over 4,000 polygynists. To insure that this subset of data was valid, we had each listing hand-verified against the family group sheets on file in our archives. The following checks were made: (1) husband's marriage and death dates, (2) husband's marriages and marriage dates, and particularly the possible double entry of a wife under slightly different name spellings, (3) children's birth dates. Any recording inconsistencies, keying error, or linking errors

as a polygynous. A separate search of the computerized genealogy was made for two-wife families in which the first was completely infertile. Only 23 cases were identified, of which 14 were verified as polygynous and included. Infertility was observed in 1.1 per cent of first wives in two-wife families, 2.3 per cent in three-wife families, and 1.9 per cent in families with more than three wives. In a study of the same population, using a different data set, Smith and Kunz[14] also found the lowest level of childlessness (0.8 per cent) among the first wives in two-wife families. This suggests that any biases in our data relating to infertile first wives are slight. Thus our conservative definition of polygyny omits a number of ambiguous cases where no overlap occurred. Those relatively few cases where both (or more than two) wives are fertile but their marriage and child birth dates are completely separate are also omitted.

In the majority of the analyses presented below, we present data for three birth cohorts of polygynists in order to reflect the changing conditions under which this form of marriage was practised. These cohorts represent groups contracting multiple marriages during the introduction, the widespread practice, and finally, the period of the demise of this marriage system.

1. The first cohort consists of husbands born before 1820. They represent the initiators of this marriage form, and typically would include those who began the practice of plural marriage in Nauvoo, Illinois, and Utah Territory before it was publicly supported by the L.D.S. Church in 1852.

2. The second cohort consists of husbands born between 1820 and 1839. They became adult at a time when some were taught and observed this marriage form. They would have been between 50 and 70 years old when the Church reversed its position on plural marriage and, thus, could have practised it with the Church's approval during the majority of their lives.

3. The third cohort, born between 1840 and 1859, represents a group who may have been born into a plural-marriage family and who entered into a plural marriage themselves. They would have been between 30 and 50 years old when the Church disavowed this marriage pattern.[15]

The basic characteristics of the polygynous husbands and wives are presented in Tables 1 and 2, and illustrate the importance of distinguishing among the three cohorts defined above. As indicated in Panel A of Table 1, members of the initial cohort contracted a larger number of marriages; on average 3.9 compared to 2.4 for the last cohort. In the earliest cohort 47 per cent had four or more wives; in the second, 47 per cent had two

resulted in removal of the listing from the subset. Over five per cent ($n = 146$) of verified cases were not used in the analysis presented in this paper because they were born after 1859.

Several additional comments concerning the completeness of the data are necessary. For approximately 13 per cent of the wives, full genealogical information is not available. In these cases only her name and perhaps the marriage date are present. When the marriage date is available, her proper order in the marriage chain can be determined; and the other wives (with more complete information) can be analyzed in their correct position. When marriage date is absent, the marriage is included only to determine the husband's total number of marriages, but is excluded from all other analyses.

One family type occurred which led to the omission of 199 marriages. When a man's first wife died young, and he remarried and later married again (becoming a polygynist), the first marriage of brief duration was omitted from the analysis.

[14] An important demographic study of this population is reported in Smith and Kunz, *loc. cit.*, in footnote 12. That project was focused on the fertility–polygyny hypothesis. They, however, used data from a published volume of biographies of founders of the territory, and because a fee was required for inclusion, a class bias may exist in their data. Nevertheless, Smith and Kunz's study is the first systematic demographic analysis of the phenomenon for this population, and, therefore, provides an unusual opportunity to compare the results of our study with a similarly motivated effort in which a completely independent data set was used.

[15] A small proportion of these individuals continued to practise polygyny, sustained by an 'underground' network of supporters. Plural marriages were approved and performed by Church leaders in Mexico and elsewhere until a second manifesto in 1904.

Table 1. *Husband's information by birth cohort*

A. Number of wives

Birth cohort	*N*	Mean	S.D.	Percentage 2	3	4+	Total	Maximum number
Before 1820	490	3.9	2.0	23.3	29.4	47.3	100.0	18
1820–39	1,201	2.9	1.1	47.2	31.6	21.2	100.0	10
1840–59	843	2.4	0.8	69.5	23.3	7.2	100.0	8

B. Husband's mean age at each marriage

Birth cohort	First			Second			Third			Once-married		
	N	Mean	S.D.	*N*	Mean	S.D.	*N*	Mean	S.D.	*N*	Mean	S.D.
Before 1820	489	27.4	8.1	488	40.6	7.8	334	45.2	8.9	1,953	27.2	7.0
1820–39	1,200	24.6	5.2	1,199	33.8	6.7	560	40.3	9.2	4,248	26.6	6.2
1840–59	843	22.9	3.4	840	31.7	5.6	226	41.6	12.4	9,081	25.1	5.1

C. Husband's mean age at last birth for each marriage*

Before 1820	340	45.9	8.5	251	55.1	9.8	151	58.8	9.3	1,594	44.8	7.5
1820–39	859	44.3	7.0	762	50.9	8.4	289	54.4	8.8	3,407	45.2	7.4
1840–59	666	44.1	5.7	537	49.1	7.9	105	53.2	8.3	7,795	44.9	6.5

* For marriages in which the couple survived until the wife's 45th birthday.

wives; and in the last cohort 69 per cent had two wives. The maximum number of wives was 18 for the first group and eight for the last group.[16]

The decrease in mean age at first marriage (Table 1 B) in successive polygynist cohorts indicates the timing of arrival on the frontier. The majority of members of the first cohort were born in the Eastern U.S. (58 per cent) or Great Britain (25 per cent) and arrived in the territory after their first marriage. Generally speaking, members of the last cohort were born in Utah Territory or came as youths; thus, their first marriages reflect those of a frontier society. In the last two cohorts once-married men tended to many later in life than those men who eventually contracted a second or higher-order marriage. The age at second marriage emphasizes that marriage patterns in the first cohort changed within their own lifetime. They began their marital life in a monogamous society, and at about age 40 took a second wife. In the next two cohorts, men were, on average, in their early 30s when they married a second wife.

Among once-married males, there was basically no difference between birth cohorts in their age at the birth of the last child, and that observation is essentially valid for the first marriages of polygynous husbands (Table 1 C). Even though the husband was much older at the birth of the last child in second and third marriages, this age declined in successive cohorts.

Data for wives in multiple marriages presented in Table 2 again indicate a decline in the mean age of marriage for once-married wives, and first and second wives in multiple marriages. The decline in the mean age at marriage may, as in the case of husbands, simply reflect the influence of settlement on the frontier. There is no systematic change in the mean age at last birth in the three cohorts defined by husband's date of birth (see Table 2 B). Nevertheless, there is a relationship between wife-order and age at termination of childbearing, which suggests the possibility of termination of exposure to risk of childbearing because of the death of the husband, as the difference between the age of the spouses increases with order of wife (see Table 2 D). For example in the second cohort,

[16] A few well-known individuals had more wives than are included in our files, but the omissions are not significant in terms of number of husbands or total number of wives omitted.

Table 2. *Wives' information by wife order and husband's birth cohort*

Birth cohort	First			Second			3 to 6			Once-married		
	N	Mean	S.D.	*N*	Mean	S.D.	*N*	Mean	S.D.	*N*	Mean	S.D.
					A. Mean age of marriage*							
Before 1820	444	21.3	5.2	413	23.9	7.3	517	23.1	7.4	1,953	22.1	4.5
1820–39	1,124	20.7	4.6	1,086	21.3	5.7	707	22.5	6.4	4,248	21.6	4.7
1840–59	821	19.4	3.7	777	21.0	4.7	221	23.1	6.1	9,081	20.2	3.8
					B. Mean age at last birth†							
Before 1820	340	40.3	5.3	251	39.7	5.1	281	38.5	5.8	1,594	40.2	4.9
1820–39	859	40.7	4.8	762	39.3	5.3	437	38.6	5.1	3,407	40.6	4.9
1840–59	666	40.7	4.5	537	38.7	5.6	128	38.9	5.1	7,795	40.2	5.1
					C. Number of live births‡							
Before 1820	444	7.9	3.5	406	5.9	3.7	522	5.1	3.6	1,941	7.4	3.1
1820–39	1,127	8.3	3.4	1,069	7.0	3.5	685	5.9	3.5	4,225	8.1	3.2
1840–59	819	9.0	3.1	747	6.5	3.4	209	5.5	3.3	9,031	8.4	3.0
					D. Age difference between husband and wife							
Before 1820	444	6.0	7.7	411	16.2	9.5	537	22.0	9.9	1,953	5.1	6.6
1820–39	1,124	3.9	6.0	1,088	12.4	7.8	732	17.7	8.9	4,248	5.0	6.5
1840–59	821	3.5	4.1	779	10.4	6.2	234	15.2	7.6	9,081	4.9	4.9

* These tables for wives married between ages 10 and 45.

† For wives married between ages 10 and 45. For marriages in which the couple survived until the wife's 45th birthday.

‡ For wives married between ages 10 and 45. Stillborn and adopted children were omitted. *N* for once-marrieds is smaller in this table because of additional comparisons between marriage date and each child's birth date.

the husband is on average 3.9 years older than his first wife, but 17.7 years older than his third or later wives.

Differences in age at marriage, age at birth of the last child, and age difference between the spouses are all sharply reflected in the number of live births reported in Table 2C. The number of children ever born (CEB) to women in polygynous unions is clearly linked to wife-order. First wives had more births than second and later wives, but they also bore more children than women in 'once-married' unions. This is not particularly surprising given that first wives in multiple-wife unions are younger at marriage, closer to their husbands in age, and persist in childbearing for slightly longer than second or later wives. While the number of children ever born was linked to wife-order, if we aggregate the fertility of multiple wives, the mean number of children ever born would have been 6.25 for the first birth cohort, 7.26 for the second, and 7.55 for the third.[17] Thus the average fertility of all polygynous wives was lower than that of once-married women, a result consistent with the traditional polygyny–fertility hypothesis. Yet our data indicate substantial differences in fertility by wife-order, and it is this phenomenon which requires explanation.

ANALYSIS

In the introduction, we noted that ascertainment of the effect of marriage types on fertility is simplified among populations in which fertility limitation is not practised, that is, among populations with natural fertility. We begin the analysis by presenting two tests

[17] The rise in the number of children ever born across the birth cohorts is in part related to the changes in age at marriage. However, this rise is consistent with the pattern of fertility change observed in a wide variety of populations before the obset of a systematic transition from high to low fertility.

of the assumption that the population studied represents a population with natural fertility. In other papers we have demonstrated that fertility of once-married women in the cohorts studied in this paper follows a natural fertility schedule.[18] To avoid repetition, we restrict our analysis to polygynous wives.

A widely used index designed to reflect the absence of fertility limitation, and conversely, the presence of a natural fertility schedule is the *m* index and the related *M* index.[19] The *M* index expresses the level of fertility and *m* is an index of the degree of deviation from an age-specific model natural fertility schedule. *m* is unbounded so that while a value of zero indicates approximation to a model natural fertility schedule, negative values are possible. Calculation of these indices also assumes an age-specific pattern of deviations from the model 'natural fertility' schedule ($v(a)$) which may be inappropriate for polygynous unions. However, increasing values would indicate increasing adoption of fertility control; and within a population sub-group, variations in the value of *m* should reflect variations in the degree of adoption of age-specific fertility control.

Marital age-specific fertility rates and the values of *m* and *M* are presented in Table 3. The index of the level of fertility (*M*) is consistent with data relating to children ever born presented in Table 2C; it is highest for first wives and decreases with order of wife. The index of control, *m*, is typically consistent with our assumption that, regardless of marriage order, no significant degree of fertility limitation is evident. Differences by wife-order are relatively small, and all values are near zero with one exception – the value of *m* for third to sixth order wives in the birth cohort 1820–39. However, the mean square error indicates only a moderately good fit to the curve, a result which supports suspicion of greater variability in these groups.

Table 3. *Marital age-specific fertility rates, m, and M by husband's birth cohort and wife order*

Wife	15–19	20–24	25–29	30–34	35–39	40–44	45–49	*m*	*M*	MSE*
					Cohort Before 1820					
1st	0.4273	0.4577	0.4134	0.3849	0.3272	0.1846	0.0266	−0.076	0.958	0.0009
2nd	0.3484	0.4313	0.4049	0.3581	0.3051	0.1487	0.0183	0.028	0.942	0.0004
3–6	0.3448	0.3987	0.3761	0.3375	0.2709	0.1284	0.0151	0.079	0.887	0.0005
					Cohort 1820–39					
1st	0.4406	0.4577	0.4314	0.3948	0.3379	0.1935	0.0244	−0.098	0.972	0.0008
2nd	0.3830	0.4309	0.4071	0.3749	0.2986	0.1494	0.0177	0.033	0.951	0.0002
3–6	0.3692	0.4267	0.3956	0.3462	0.2623	0.1047	0.0147	0.255	0.982	0.0041
					Cohort 1840–59					
1st	0.4644	0.4727	0.4287	0.3922	0.3302	0.1872	0.0268	−0.058	0.991	0.0010
2nd	0.3861	0.4165	0.3749	0.3154	0.2570	0.1333	0.0122	0.094	0.888	0.0006
3–6	0.3729	0.3809	0.3996	0.3338	0.2691	0.1418	0.0049	0.020	0.868	0.0016

* Mean square error. *m* and *M* have been based on MASFR using ages 20–24 ... 45–49 and regressing over ages 20 to 44. Ages 15–19 not used in calculating *m*.

A more traditional alternative is found in the examination of marital age-specific fertility rates. Typically a population of natural fertility would generate a convex curve, while that of a population with fertility control would be concave. The marital age-specific

[18] G. P. Mineau, L. L. Bean and M. Skolnick, *loc. cit.* in footnote 11; J. Dennis Willigan, *et al.*, *loc. cit.* in footnote 11.

[19] Ansley J. Coale and T. James Trussell, 'Model fertility schedules: variations in the age structure of childbearing in human populations', *Population Index*, **40** (1974), pp. 185–201; and 'Technical note: finding the two parameters that specify a model schedule of marital fertility', *Population Index*, **44** (1978), pp. 203–213.

distributions for our sub-cohorts and sub-groups are presented in Figure 1. The anomaly, suggested by the high value of m for wives of orders three to six, is not evident in the plots. The curves as well as the values of M indicate that the fertility levels of sub-groups and separate cohorts vary, but no single group appears to have adopted parity-dependent methods of fertility limitation.[20]

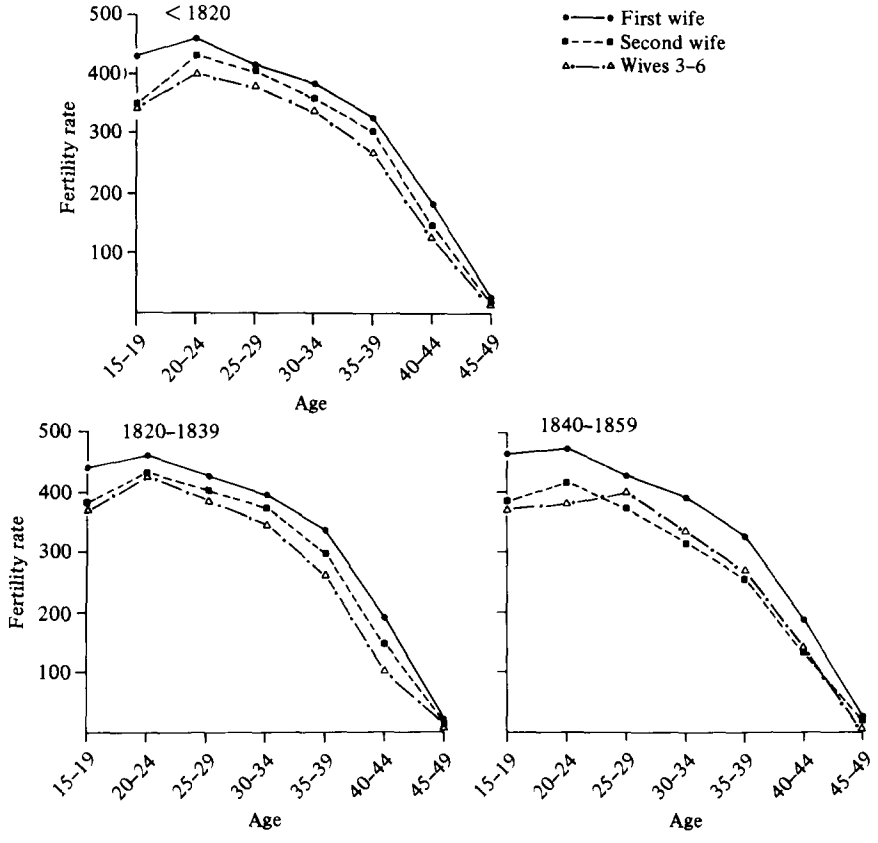

Figure. 1. Marital age-specific fertility distribution for first wife, second wife, and wives 3 to 6 by husband's birth cohort.

Data are consistent with our assumption that polygynous wives, regardless of order or husband's birth cohort, did not practise age-specific fertility limitation; thus, we focus our attention on accounting for the differences in fertility among wives by order. Recall that the data presented in Table 2 indicated that fertility of first wives in polygynous unions was higher than that of either once-married wives or second or later wives in polygynous unions for each of the three cohorts examined. In addition, we observed that first wives married younger than later wives, continued to bear children to a later age, and that age differences between them and their husband were smaller. Consequently, the following variables have been selected for analysis to explain the differences in fertility by wife-order:

1. Wife's age at marriage.
2. Number of co-wives.
3. Spacing behaviour.

[20] Logue's recent study, *loc. cit.* in footnote 12, of 446 families resident in one southern Utah town indicates similar values of m for monogamous and polygynous wives although he includes fertility of first wives in the monogomous tabulations until a second wife is added.

4. Duration of exposure to the risk of conception.
5. Age of husband.

We summarize the results of the cross classifications examined to test the effects of these variables, singly or in combination. Illustrative tables are presented, and full sets of tables are available from the authors.

1. Wife's age at marriage. A control for age at marriage is introduced by tabulating children ever born by husband's birth cohort by wife-order within three age-of-marriage groups: 10–19, 20–24, and 25 plus. In addition, we only include marriages in which spouses survived until the wife's 45th birthday and in which fertility was then completed. The expected inverse relationship between fertility and age at marriage is noted (see Table 4). The differences in fertility by wife-order are reduced, but first wives, married before their 25th birthday had more births than once-married women or second and later wives. First wives married after their 25th birthday bore more children than higher-order wives, and attain the number of children born to once-married women in the second and third cohorts.

Table 4. *Number of live births by wife order, wife's age at marriage, and husband's birth cohort for completed families**

Birth cohort	Married 10–19			Married 20–24			Married 25–44		
	N	Mean	S.D.	*N*	Mean	S.D.	*N*	Mean	S.D.
				First wife					
Before 1820	164	9.6	3.3	116	8.5	2.8	77	4.6	2.6
1820–39	456	9.9	3.0	293	8.7	2.6	139	5.7	3.0
1840–59	456	10.0	2.6	171	8.5	3.1	50	6.0	2.8
				Second wife					
Before 1820	79	8.7	3.5	72	7.6	3.2	117	4.2	2.6
1820–39	364	9.1	3.2	228	7.7	2.8	190	4.8	2.5
1840–59	271	8.4	3.1	182	6.7	2.7	98	4.3	2.3
				Wives 3 to 6					
Before 1820	129	8.0	3.3	56	7.7	2.8	110	3.3	2.4
1820–39	189	8.3	3.2	123	7.0	2.6	142	4.1	2.6
1840–49	55	8.6	2.9	34	6.2	2.4	42	3.8	2.2
				Once-married wife					
Before 1820	560	9.1	3.0	698	7.7	2.7	377	5.2	2.6
1820–39	1,517	9.6	3.0	1,313	8.1	2.7	748	5.8	2.6
1840–59	4,353	9.4	2.9	2,687	8.1	2.6	808	6.0	2.6

* Couples surviving until the wife's 45th birthday and no divorce recorded.

2. Number of co-wives. The number of live births has been tabulated by wife-order and number of wives in the family for marriages with complete fertility (not shown). We have specified the mean number of children born to first wives in two-wife families, three-wife families, and families with more than three wives. Comparable tabulations were made for second wives and third wives. The addition of wives reduces the number of children ever born for first wives, but there is no systematic change for second or third wives when more wives are added. For example, in the cohort born between 1820 and 1839, first wives had 9.3 children on average in two-wife families, 8.3 in three-wife families and 7.8 in families of more than three wives. The first wife in a two-wife family is an 'only' wife for several years longer than the first wife in a family including four or more wives; thus, part of the difference appears to be a function of the number of years of marriage before another wife is added.

3. Spacing behaviour. The addition of wives into a family might typically require the establishment of separate households, and thus lead to periods of separation between the husband and some of his wives.[21] Such separations might be reflected in variations in spacing behaviour. Analysis of birth intervals for once-married women also strongly suggests that birth spacing was practised in the Utah population.[22] Three analyses of birth intervals have been made (see Table 5): mean interval from marriage to first birth; mean birth intervals excluding the first; and mean birth intervals omitting the first, ultimate and penultimate intervals. The latter tabulations were made to allow for possible truncation among a select few women whose numbers would not influence the shape of the marital age-specific fertility distribution sufficiently to suggest the adoption of parity-dependent control.

Table 5. *Birth interval data by father's birth cohort by wife order*

	First			Second			3 to 6			Once-married		
Cohort	*N*	Mean	S.D.	*N*	Mean	S.D.	*N*	Mean	S.D.	*N*	Mean	S.D.
					A. First birth interval*							
Before 1820	383	1.29	1.0	334	1.66	1.2	408	1.75	1.4	1,293	1.38	1.3
1820–39	979	1.37	1.0	964	1.59	1.2	589	1.61	1.2	2,985	1.31	1.1
1840–59	770	1.25	1.0	680	1.70	1.3	177	1.67	1.3	7,780	1.23	0.9
					B. Mean birth intervals excluding the first birth interval†							
Before 1820	420	2.52	0.7	348	2.60	1.0	409	2.55	0.9	1,874	2.76	1.0
1820–39	1,073	2.45	0.7	981	2.55	0.8	587	2.57	0.9	4,034	2.65	1.0
1840–59	798	2.45	0.7	689	2.74	1.1	183	2.64	0.9	8,853	2.63	0.9
					C. Mean birth intervals excluding first, ultimate and penultimate‡							
Before 1820	384	2.37	0.8	280	2.34	0.7	318	2.33	0.6	1,688	2.48	0.8
1820–39	1,014	2.25	0.5	863	2.30	0.6	495	2.29	0.6	3,731	2.39	0.8
1840–59	778	2.23	0.4	579	2.40	0.7	142	2.37	0.9	8,361	2.33	0.7

* This analysis omits families in which there is no recorded marriage date, the first child had no recorded birth date, the first child was born before the marriage, or the first child was born eleven or more years after the marriage.

† This analysis does not include the interval from marriage to first birth and, therefore, only data relating to families with two or more children are used. When an interval less than 8 months (0.667) or greater than 14 years was calculated, it was not used in averaging the family's mean interval.

‡ This analysis omits the interval from marriage to first birth and the last and penultimate intervals. Only data relating to families with four or more children were used.

As indicated in Table 5A, the length of the first birth interval is directly related to wife-order. The mean birth interval of wives of orders 3–6 married to husbands born between 1820 and 1839 is about one-quarter of a year longer than the first birth interval of first wives married to men born during the same period. Excluding first births, the mean birth intervals reported in 5B similarly indicate a slight tendency for average birth intervals of first wives to be shorter. Data in 5C imply that ultimate and penultimate birth intervals of first wives in the first two cohorts may also have been shorter. The birth intervals of once-married couples are quite different. These differences, combined with slightly older ages at marriage, account for the difference between the completed fertility of once-married wives and that of first wives in polygynous families.

[21] Separate households for polygynous wives may, of course, be a phenomenon which is peculiar to the population studied. In the typical African agricultural setting a common family compound is maintained, although separate quarters may be assigned to each wife. However, with increasing urbanization some significant proportion of polygynous husbands may retain an agricultural holding worked by one or more wives and their children while he works in an urban setting maintaining a separate wife and household.

[22] Douglas L. Anderton and Lee L. Bean, 'Birth spacing and fertility limitation: a behavioural analysis of a nineteenth century frontier population', *Demography* **22** (1985), pp. 169–183.

Table 6. *Mean birth intervals by mother's age at birth*

		20–24	25–29	30–34	35–39	40–44
Intervals of first wife						
Interval before second wife added	Mean	2.01	2.24	2.27	2.50	2.71
	N	395	562	400	252	55
Interval during which second wife added	Mean	2.20	2.38	2.64	2.80	3.29
	N	301	561	527	327	171
First wife has child less than nine months after second marriage	Mean	2.02	2.15	2.37	2.41	2.92
	N	121	224	179	113	34
First wife has child nine months or more after second marriage	Mean	2.31	2.53	2.77	3.01	3.38
	N	180	337	348	214	137
Interval after the second wife added	Mean	2.03	2.13	2.35	2.57	3.00
	N	156	427	518	340	155
Intervals of second wife						
Interval before third wife added	Mean	2.00	2.22	2.26	2.40	
	N	113	134	96	41	
Interval during which third wife added	Mean	2.12	2.62	2.72	2.99	
	N	112	145	146	83	
Second wife has child less than nine months after third marriage	Mean	1.96	2.30	2.42	2.43	
	N	40	39	46	23	
Second wife has child nine months or more after third marriage	Mean	2.20	2.73	2.86	3.21	
	N	72	106	100	60	
Interval after the third wife added	Mean	1.90	2.22	2.41	2.55	
	N	65	130	137	87	

The interval from marriage to first birth was not used in this analysis. Intervals shorter than eight months were omitted, as were intervals equal to or greater than ten years.

One further birth interval analysis is of interest. In Table 6 we examine the birth intervals of first and second wives (controlling for age) just before, during, and just after the addition of another wife. In these tabulations the interval from marriage to first birth is excluded. The closed interval before the addition of the second wife and the closed interval after the addition of the second wife are approximately equal in age groups under 40. The addition of a second wife did not seem to result in behavioural changes favouring the second wife to the exclusion of the first, except during the interval when the second wife was added. If the first wife was not pregnant when the second wife entered the family, she encountered some delay in becoming pregnant. The same pattern holds for second wives when third wives are added. Specifically, the birth interval, during which the third wife is added, is slightly longer than the previous or subsequent interval, regardless of the wife's age. Thus, the data suggest a short time, one-cycle impact on the length of the birth intervals of lower-order wives as more wives are added to the family.

4. Duration of exposure to the risk of conception. The primary factor affecting the length of exposure to the risk of conception for wives specified by marriage order is the difference between husband's and wife's ages, so that higher-order wives with much older husbands are more likely to be widowed. The variations in exposure patterns are evident from the data presented in Table 7. The duration of exposure to risk of conception is the time from marriage until the wife's 45th birthday or until one of the spouses dies, if earlier. About 200 records indicate that a divorce occurred; this information has also been included in the calculation of exposure. Five per cent or fewer of first wives are exposed to the risk of conception for less than ten years. This is approximately equal

to the figures observed for once-married women. However, between 8.3 and 15.9 per cent of second wives experience such short periods of exposure, and between 14.4 and 22.7 per cent of third wives fall into the same group. A secondary factor related to shorter durations is the proportion of wives who marry after their 34th birthday. For example, in the earliest cohort two per cent of first wives compared to ten per cent of third and later wives marry at older ages.

Table 7. *Duration of exposure* in years by husband's cohort by wife order*

Birth cohort	*N*	Mean years	S.D.	Percentage 0–9 yrs	10–19	> 20	Total
			First wife				
Before 1820	435	22.1	6.1	5.1	25.1	69.9	100.1
1820–39	1,088	22.8	5.7	4.1	20.0	75.8	99.9
1840–69	808	24.2	5.1	2.7	13.0	84.3	100.0
			Second wife				
Before 1820	377	18.5	7.7	15.9	36.1	48.0	100.0
1820–39	1,028	21.3	7.1	10.2	23.7	66.1	100.0
1840–59	720	21.6	6.7	8.3	22.4	69.3	100.0
			Third to sixth wife				
Before 1820	471	17.9	8.8	22.7	29.7	47.6	100.0
1820–39	640	19.7	7.8	14.4	28.6	57.0	100.0
1840–59	196	18.7	7.9	16.8	31.6	51.5	99.9
			Once-married				
Before 1820	1,943	21.8	5.2	3.6	26.0	70.4	100.0
1820–39	4,233	22.4	5.4	3.4	23.6	73.0	100.0
1840–59	9,064	23.8	4.9	2.3	14.2	83.5	100.0

* From marriage until wife's 45th birthday or death of either spouse if earlier.

Multiple classification tables were constructed to determine whether the introduction of controls for selected variables would account for the differences in fertility by wife-order. As we have indicated above, controlling for age at marriage does not completely eliminate wife-order-specific fertility differences. Controlling for duration of exposure also fails to eliminate wife-order-specific differences (not shown). For example, first wives married to husbands born between 1820 and 1839 and exposed to risk of conception for between 10 and 19 years had 6.3 live births on average, while second wives in the same category had 5.5 and third and later wives, 4.9.

5. Age of husband. Data presented in Table 8 suggest a moderately strong effect of age of husband at marriage. Men marrying between the ages of 25 and 29 will on average have 7.7 children while men marrying between ages 40 and 44 will produce 5.7. Note that the column headings indicate the age of husband at the time of marriage to each wife-order group: first, second, and third to sixth. A man who married a first wife when aged between 20 and 24 may marry a second wife between ages 25 and 29 and a third wife between ages 30 and 34. Thus, to ascertain the effect of husband's age at marriage the values along a diagonal line must be compared. The pattern observed along the diagonal indicates that men who married second or later wives at successively older ages, would produce fewer children.

Two additional tables were constructed, only one of which is presented here because of space limitations. In the first case (not shown), we control simultaneously for duration of marriage and wife's age at marriage; this leaves intact the conclusion that differences

Table 8. *Mean number of children ever born by husband's age of marriage, marriage order, and birth cohort*

Marriage	Husband's age at marriage									
	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69
					Cohort < 1820						
First	7.9	8.5	7.9	7.2	7.1	6.3	7.3	—	—	—	—
Second	—	—	6.5	6.5	5.9	5.8	5.1	5.7	4.8	—	—
3 to 6	—	—	—	5.3	6.7	5.3	5.6	4.7	4.3	2.7	—
					Cohort 1820–39						
First	8.7	8.6	8.2	7.5	6.5	6.1	—	—	—	—	—
Second	—	7.5	7.7	6.9	7.2	5.6	6.5	4.8	—	—	—
3 to 6	—	—	7.7	6.8	6.4	6.1	5.1	4.3	4.4	2.7	—
					Cohort 1840–59						
First	9.7	9.1	8.3	7.9	6.6	—	—	—	—	—	—
Second	—	6.4	7.2	6.5	5.7	5.5	4.9	—	—	—	—
3 to 6	—	—	6.1	6.4	5.4	5.7	4.9	—	—	—	—

Cells with fewer than ten cases are not reported.

between the number of children ever born persist. Within age-at-marriage groups, and typically for each duration category, the number of children ever born decreases with wife-order. The numbers of children ever born, reported in Table 9, arise from the simultaneous introduction of four control variables: wife's age at marriage, husband's age at marriage, duration of marriage at wife's 45th birthday and wife-order. With one exception, first wives have more births than any later wife. In two thirds of the comparisons number of children ever born to the second wives is higher than that to wives of orders 3–6, but the differences are slight. Comparing these results with Table 4 and grouping raw data across cohorts, similar conclusions may be drawn. First wives who marry between ages 20 and 24 and who survive to their 45th birthday have 8.6 children on average, second wives have 7.3, and later wives have 7.1; comparable results are seen in Table 9, panel 3.

In summary, recognizing the differences in fertility by wife-order, we have attempted to explain these by controlling for a number of proximate determinants of fertility. Our sequential introduction of control variables results in a reduction of the differences between children ever born by order of wife. Our multiple classification indicates that differences between children ever born of second and later wives are largely eliminated, although the fertility differences between first wives and all other wives remain. This clearly suggests the importance of the unique period of monogamous marriage experienced by first wives.

SUMMARY AND CONCLUSIONS

Previous studies of fertility variations among populations which practise polygyny have led to weak, and in some cases, inconsistent support for the traditional hypothesis that the fertility of polygynous wives is lower than that of monogamous wives. Such results appear to be derived from inadequate data sets which may reflect reporting errors and be limited in terms of the types of variables available for analysis. Furthermore, the typical aggregation of all polygynous wives in the computation of average fertility rates which are then compared with the rates or levels of fertility among monogamous wives fails to identify variations in fertility among polygynous wives which may account for

Table 9. *Mean number of children ever born for selected combinations of wife's age at marriage and years of exposure by husband's age at marriage and wife order (all birth cohorts combined)*

Husband's age	Wife order		
	First	Second	3–6
Wife's age = 15–19; exposure = 20–24			
12–19	9.2	—	—
20–29	9.2	8.0	—
30–39	—	8.4	8.2
40–49	—	6.1	6.2
Wife's age = 15–19; exposure = 25–29			
12–19	10.0	—	—
20–29	9.9	9.0	8.9
30–39	9.3	8.6	8.2
40–49	9.0	7.6	7.7
50–59	—	—	7.3
Wife's age = 20–24; exposure = 20–24			
12–19	8.7	—	—
20–29	8.5	7.6	6.8
30–39	8.2	7.3	6.9
40–49	9.9	6.9	7.3
50–59	—	—	6.4
Wife's age = 25–29; exposure = 15–19			
20–29	6.7	5.5	—
30–39	6.0	5.2	5.4
40–49	—	5.8	5.2
50–59	—	—	4.6
Wife's age = 30–34; exposure = 10–14			
20–29	4.5	5.4	—
30–39	4.9	3.7	3.0
40–49	—	4.2	2.9
50–59	—	—	3.7

Means reported for cells with ten or more cases.

polygynous–monogamous differences. Consequently we have suggested that a more satisfactory test of polygynous–monogamous fertility differences requires a comparison of polygynous wives specified by wife-order with monogamous wives.

In most polygynous societies additional wives are married as the husbands increase in status or accumulate wealth;[23] and, therefore, husbands may be considerably older at the time second and later wives are added to the family. With rising age, the risk of widowhood increases so that duration of exposure to pregnancy is a critical factor in any potential variations in fertility by wife-order.

Our data from a nineteenth-century Utah population, in which polygyny was widely practised, support this argument. The average level of fertility of all polygynous wives is lower than that of monogamous wives. However, this is largely a consequence of significantly lower levels of fertility, among second and later wives than among monogamous wives, while the fertility of the first wife in polygynous families is higher.

[23] A relationship between number of wives and status as measured by L.D.S. church rank has been substantiated. For example, Mealey found a greater likelihood of adding a wife in the year or two following 'calling' to a high church rank. Linda Mealey, The relationship between cultural success and biological success: a sociobiological analysis of marriage and fertility patterns in nineteenth century Mormon Utah, unpublished Ph.D. Dissertation, University of Texas at Austin, 1984.

These differences exist, even in the absence of parity-dependent fertility control among polygynous wives as measured by traditional indices of natural fertility. In attempting to explain this fertility variation between wives, we demonstrate that first wives marry earlier than once-married wives and that there is a monotonic rise in wife's age at marriage by wife-order for the last two cohorts of polygynists. Also, first birth intervals for first wives are shorter than for later wives and average birth intervals are shorter than for once-married or later wives. There is only a temporary impact of one lengthened interval when another co-wife is added. Standard cross-classifications, bivariate and multiple, indicate that variations in fertility by wife-order in polygynous families, while reduced, persist after controlling for wife's age at marriage, husband's age and duration of exposure.

Recognizing that we are dealing with a Western population in which polygyny was practised for approximately half a century only, it is important to raise the question whether the findings reported here apply to contemporary populations in which polygyny is practised. Some differences certainly exist. Among our population widow remarriage is relatively low. Where cultural rules specify widow remarriage, duration effects may be minimized. This factor alone may account for the somewhat inconsistent findings regarding the traditional polygyny–fertility hypothesis. Additionally, if husbands marry two or more wives within a relatively short period of time (minimizing the potential effect of age of husband and leading to widowhood at much older ages for second and later wives), the differences which we report here would also be reduced. Other normative patterns within individual societies may also produce different results. Caldwell's study of the Yoruba suggests that senior wives in polygynous marriages may insist on sexual abstinence late in life, or after the addition of younger wives.[24] An analysis of age-specific fertility rates by wife-order, in this case should indicate relatively sharp truncation of childbearing among first wives reflecting a form of 'parity-dependent' fertility limitation, or a departure from a natural fertility schedule. While such differences between the population studied in this paper and other contemporary populations may be important, our results confirm the need to take account of differences between the ages of the spouses at marriage, duration of exposure, and widow remarriage rules in any analysis of the fertility of polygynous populations.

In summary we have argued that comparison of the aggregate fertility of polygynous wives with monogamous wives is inappropriate. We have suggested that fertility will vary by wife-order in multiple-wife families, particularly when replacement of infertile first wives is not a paramount motive for polygyny and when there is equitable treatment of multiple wives. Our data clearly indicate an inverse relationship between wife-order and completed fertility, and these differences persist in spite of the introduction of a variety of statistical controls.

[24] J. C. Caldwell and Pat Caldwell, 'The role of sexual abstinence in determining fertility: a study of the Yoruba in Nigeria', *Population Studies*, **31** (1977), pp. 193–217.